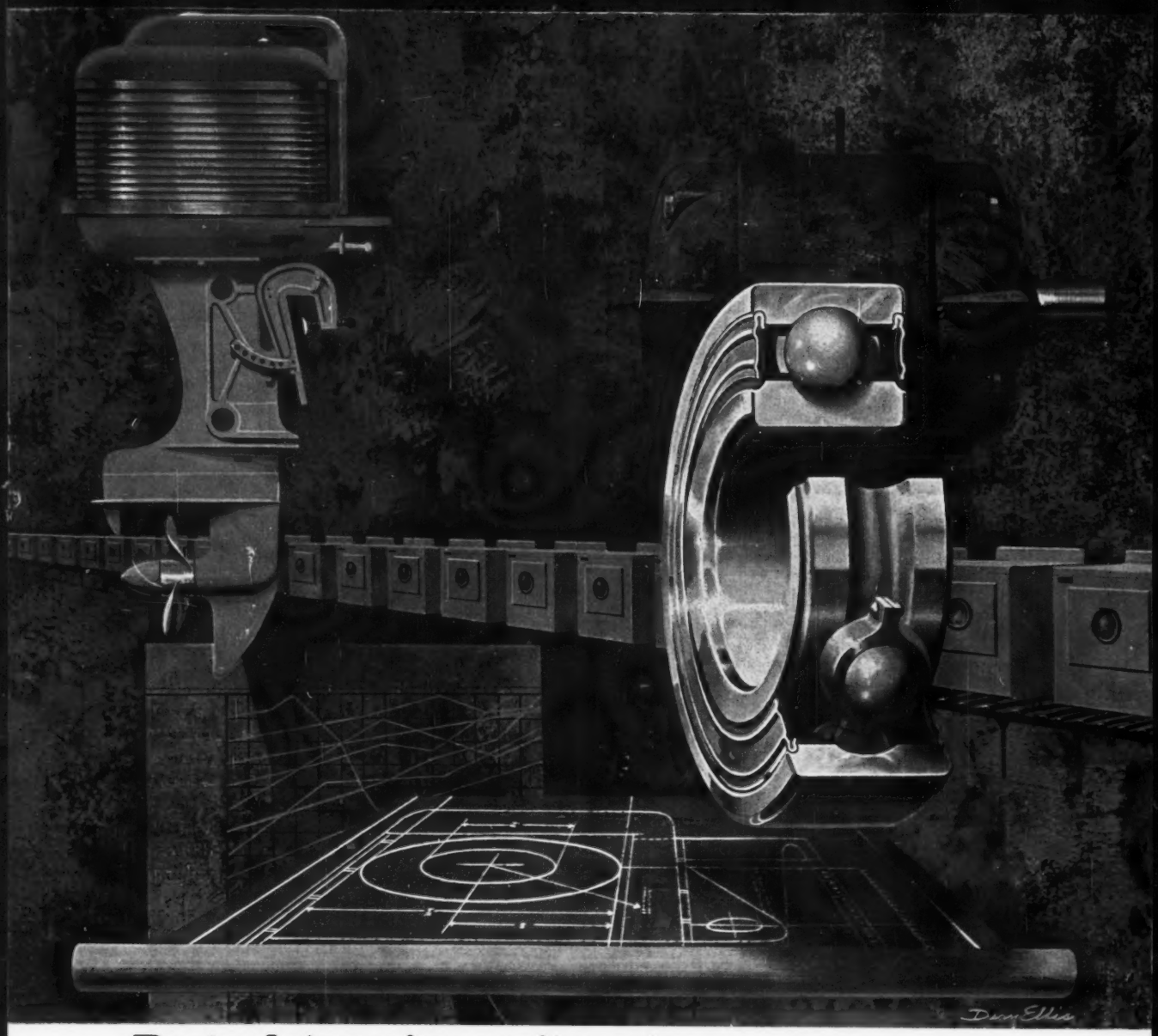
MARCH 1959—SIXTY-FIFTH YEAR

Machinery



Parts determine unit costs

The right bearing in the right place saves space and weight, cuts material costs while ensuring dependable performance. Where can you get impartial assistance in choosing the right bearing? Call SKF. No other producer offers as much experience in lowering unit costs with bearings as SKF, makers of the most complete line of ball and roller bearings.

7849

Spherical, Cylindrical, Ball, and Timken® Tapered Roller Bearings

EVERY TYPE—EVERY USE

SKF®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

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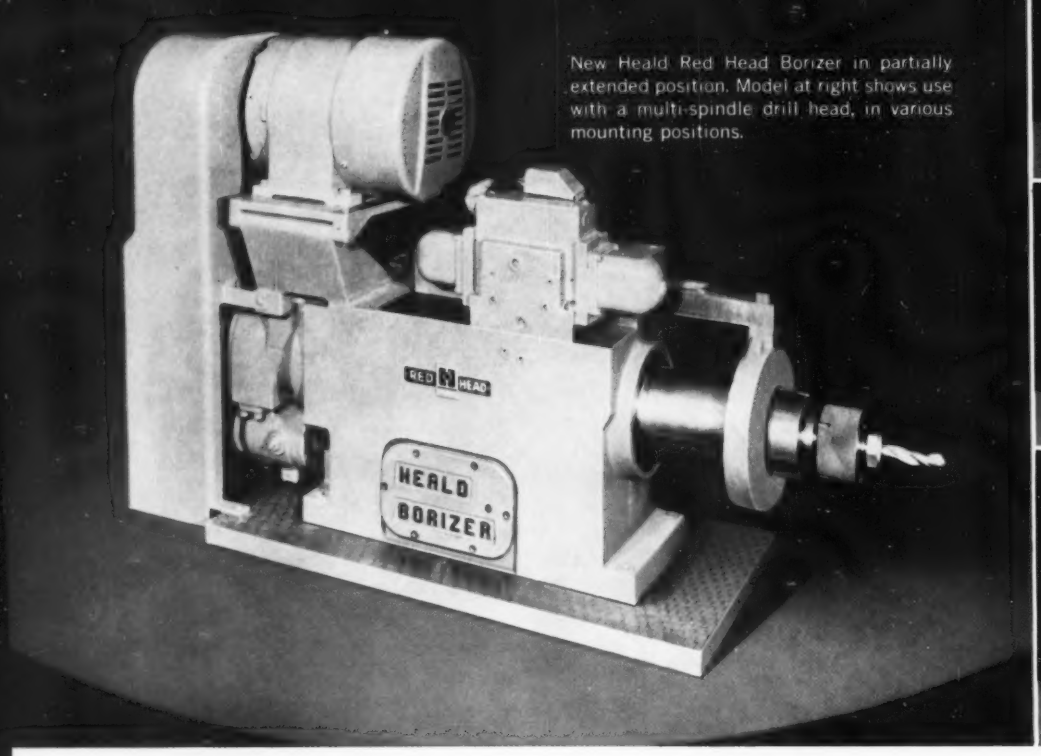
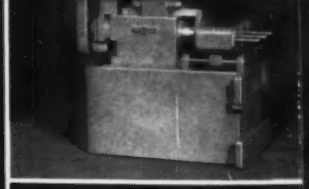
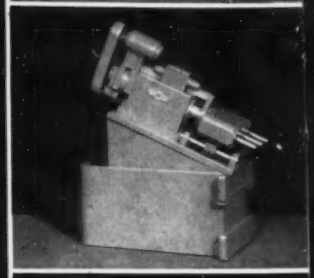
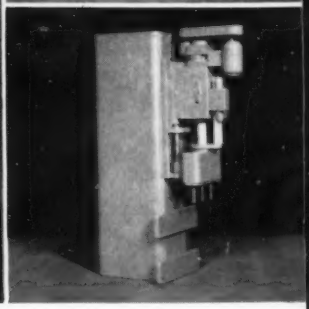
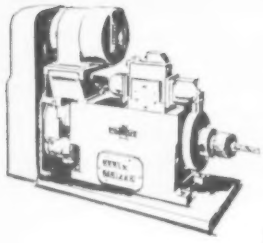


New Heald Red Head Borizer in partially extended position. Model at right shows use with a multi-spindle drill head, in various mounting positions.









Presenting the new Heald

BORIZER

Another **NEW** PRODUCT *by Heald*

☐ File for Reference
☑ Send for Bulletin

A completely self-contained unit for rotating and feeding single or multiple tools in automated setups

Designed primarily for driving multiple-spindle drill units, it rotates tools and can supply its own hydraulic power. It feeds tools in to the work at any desired rate and rapid traverses out when the operation is done. In short, the new Heald Red Head Borizer can do just about any drilling, reaming, counterboring, chamfering, and plunge facing operations. Under conditions consistent with its design and purpose it is also capable of boring operations similar to those performed on Heald Bore-Matics.

Its compact design permits grouping a number of units in a variety of positions on a single base machine or along an automated line. And its compact, self-contained construction simplifies relocation for job changeovers. Note also that this unit can be mounted horizontally, vertically or at any desired angle.

Heald Red Head Borizers incorporate the basic design and specifications of precision Red Head Boringheads and are available in four sizes, with strokes of 8, 10, 12 or 15 inches. An adequate thrust range is available for multiple drilling operations. Easily accessible dogs control cylinder stroke and adjustable valve gives infinitely variable feed rates within the feed range. The unit may be operated with integral or central hydraulic systems or with integral or centralized electrical controls.

Ask your Heald engineer for further details, or send for a copy of Bulletin No. 5-2, Issue 1.

HEALD®

It PAYS to come to Heald

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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President

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Vice-President and Treasurer

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Secretary and Publishing Manager

Editorial, Advertising, and Circulation Offices:
93 Worth St., New York 13, N. Y.
Telephone, CAnal 6-8120

Advertising Representatives

WALTER E. ROBINSON
MARK McDONALD
93 Worth St., New York 13, N. Y.

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GEORGE H. BUEHLER
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15937 W. Seven Mile Road, Detroit 35, Mich.

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British Address:
MACHINERY
National House, West St.
Brighton 1, England

French Address:
LA MACHINE MODERNE
15, Rue Bleue
Paris-IX^e, France

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Machinery

MARCH 1959 **VOL. 65 No. 7**

THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS

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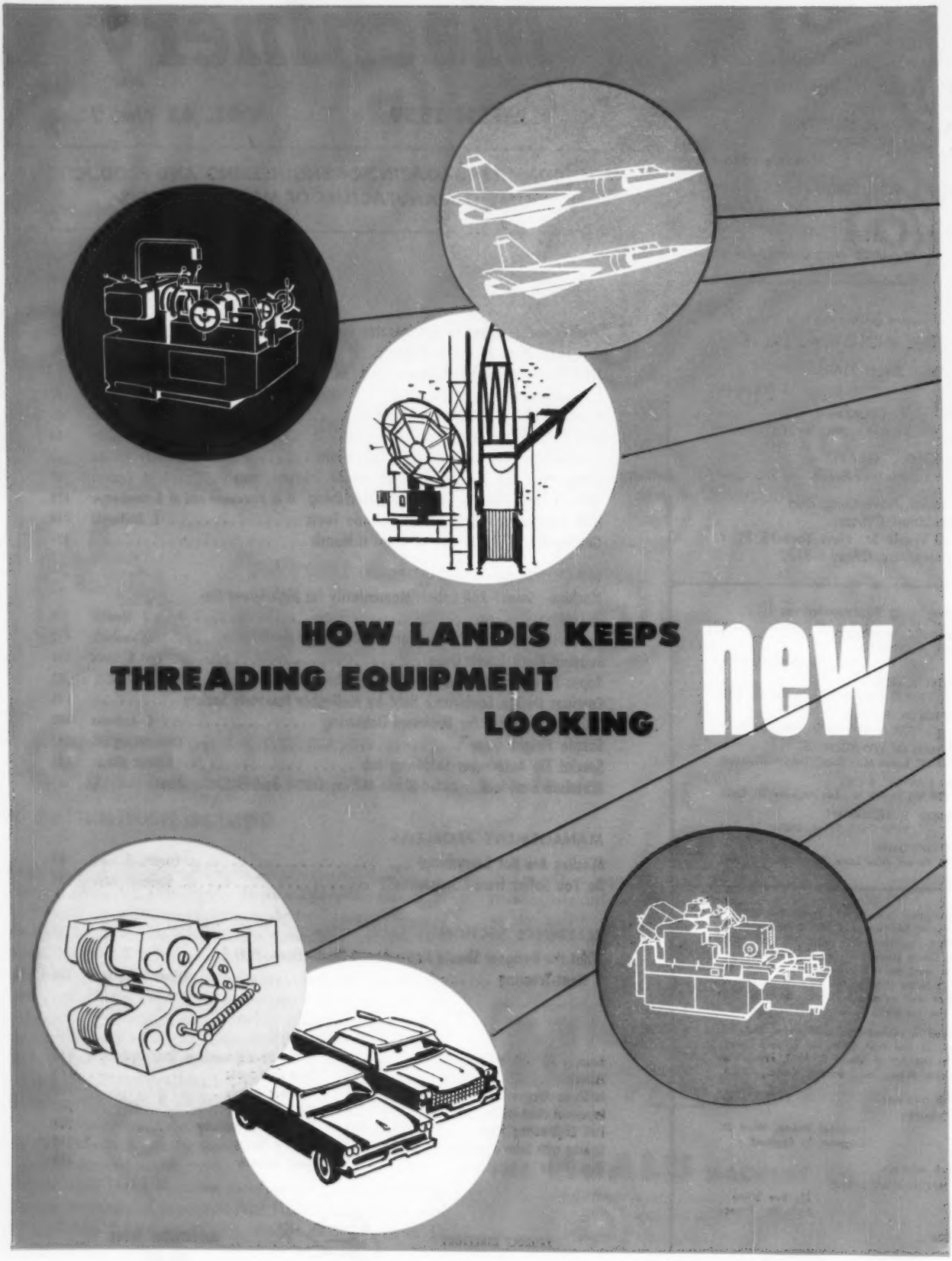

HOW LANDIS KEEPS
THREADING EQUIPMENT
LOOKING
new

Through the advance thinking of LANDIS research and development new threading equipment is constantly being introduced . . . improved to do the job faster, easier and at less cost.

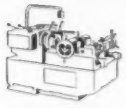
LANDIS has within the last several years produced many new developments . . . the LANROLL Thread Rolling Attachment . . . the LANHYROL Thread Rolling Machine . . . the LANDMACO C-Type Threading Machines . . . Taper Thread Rolling with the LANROLL Attachment . . . the Automatic Coupling Tapping Machine . . . Thread Rolling Heads . . . and even now new products are on the drawing boards and the testing floors. Recently released was our new production type high speed LAN-NU-ROL Thread Rolling Machine. Each of these machines and tools was designed to improve a specific threading operation. For example, new sizes and types of Die Heads and Collapsible Taps now available are suitable for many jobs that in the past could not be threaded by this equipment.

These new additions to our line emphasize our policy to continue product expansion whenever a need exists. Today, we offer the most extensive line of threading equipment available anywhere. Perhaps one of your threading jobs could be done more efficiently with a modern machine or tool developed from our half-century experience in a single field—THREADING. For detailed information, please send specifications and describe type of operation.

LANDIS *Machine* COMPANY

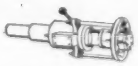
WAYNESBORO • PENNSYLVANIA • U. S. A.

THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

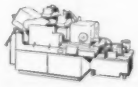


Threading Machines

Die Heads—Rotary & Stationary

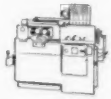


Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines

Thread Rolling Tools



Thread Rolling Machines

538C

Accurate, High-Speed **GEAR** at

58-tooth gear, 11 N.D.P., 17° 49′ helix, 2″ face width.
Grinding allowance: 0.014″ over pins.
Material: 4140 steel, 245-285 Brinell hardness
Grinding time: 15 minutes.

14-tooth pinion, 11 N.D.P., 17° 49′ helix, 2½″ face width for full depth teeth.
Grinding allowance: 0.012″ over pins.
Material: 4140 steel, 269-321 Brinell hardness
Grinding time: 8 minutes.

Tolerances:
Lead—0.0001″ per inch.
P.D. runout—0.0005″ T.I.R.
Involute profile—plus 0.000, minus 0.0002″.

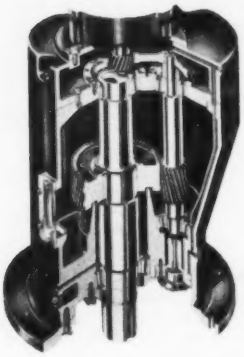
Reishauer Gear Grinding Machine

THE PRECISION LINE

Fellows

GRINDING

PHILADELPHIA GEAR



When speed reducer gears need that extra degree of precision for smoother, quieter operation, the well-known Philadelphia Gear Works grinds them on a Reishauer because it is accurate and fast. For example, grinding time was only 15 minutes for the gear and 8 minutes for the pinion shown on the opposite page.

Gear grinding by the Reishauer method is a generating process. The involute gear teeth are generated by a grinding wheel on which a helix has been developed. The tooth section of the wheel is usually that of the basic involute rack.

Fellows builds the No. 12 Fellows-Reishauer Gear Grinding Machine under license from Switzerland's Reishauer Tool Works. The No. 12 grinds in both directions of travel of the work-slide and has a built-in device for crown grinding. Short set-up time permits the economical production of single pieces as well as long runs.

Capacities for the No. 12 are: Max. O.D., spur and helical, 12"; Max. face width, *spur*, 6¾"; Max. face width, *helical*, depends on pitch and helix angle; Pressure angles, 14½° to 30°; Pitch ranges (two lead screws are available), 6 to 48 D.P. or 20 to 120 D.P.

Grinding gears by the Reishauer method will give you precision gears at real production speeds. Ask your Fellows Representative about it.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Avenue, Royal Oak, Mich.
150 West Pleasant Avenue, Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Avenue, Los Angeles 45

Gear Production Equipment

For more data, circle this page number on inquiry card

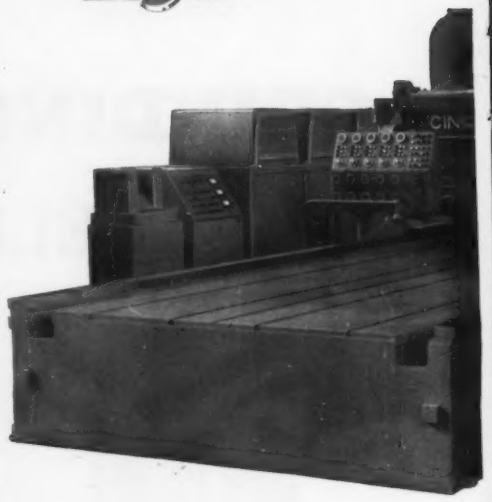
CINCINNATI

combines modern ideas with over 45 years' experience in designing and building special machinery

Cincinnati Milling's Special Machine Division has the broad experience and engineering talent to design and build special machinery and process equipment of any size and complexity. Principal functions of the Division include Engineering Service (a group of specialists who analyze the problems and prepare engineering proposals and cost estimates) . . . Special Design Engineering and product development . . . Manufacture, assembly and inspection . . . Factory run-off, using customer samples . . . Demonstration and follow-up of equipment in customer's plant.

Equipment built by the Special Machine Division incorporates the advantages of automation and numerical control, where applicable. Highly successful installations will be found in many industries . . . metalworking, paper, chemical, optical and others.

Make Cincinnati your first choice for equipment of this type. The Special Machine Division is ready to serve you.

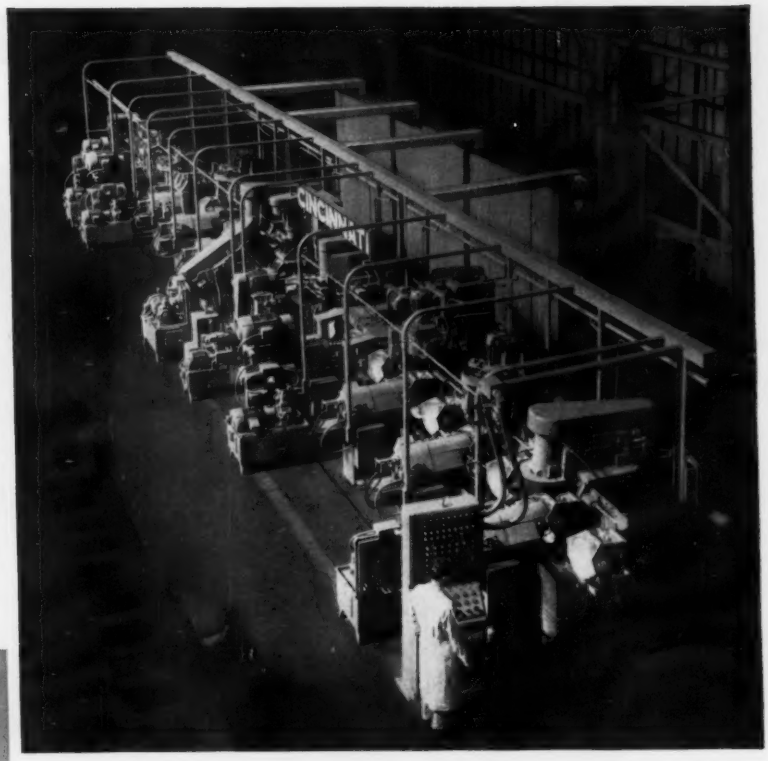


Large Numerically Controlled Milling Machine, developed and built by the Special Machine Division for the aircraft industry. An aluminum aircraft component milled on this machine is illustrated at the right. Many parts of this type are milled in ⅓ the time usually required. The machine is a gantry type, having fixed table measuring 8 ft. x 30 ft.

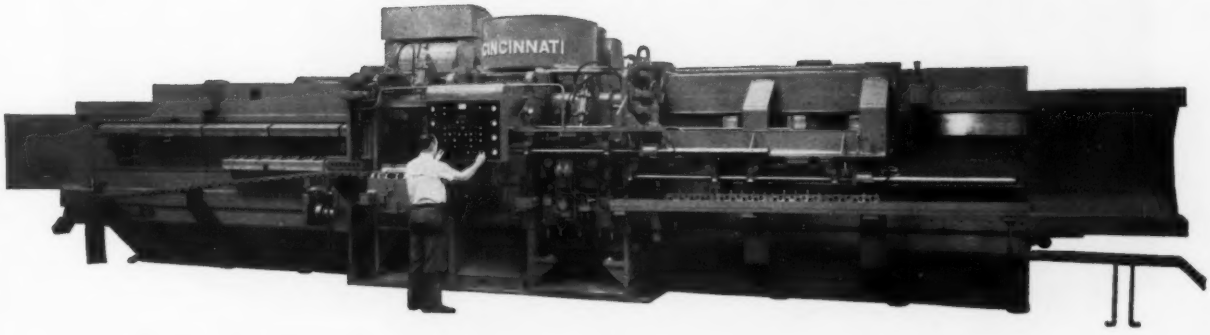
CINCINNATI Horizontal Hydro-Broach Machine, typical of the many designed and built for the automotive industry to broach cylinder heads and blocks. The machine illustrated broaches cylinder heads on the top, joint face and two manifold pads each cycle. The work progresses from the right- to the left-hand fixture. Ram speeds are adjustable, from 100 to 200 feet per min.; electro-mechanical drive; 300 hp. Production: 112 heads per hour.

CINCINNATI®

SPECIAL MACHINES • VERTICAL AND HORIZONTAL



CINCINNATI 26-Station Unit Type Transfer Line. This efficient production line automatically mills, drills and bores transmission cases in 33 operations; inserts two bushings; banks excess parts; transfers the castings from one station to the next. Several noteworthy advantages are incorporated in the line, including unit construction; one station for future engineering changes; complete static electrical control. Accuracy and finish obtained are excellent. The line cycles at the rate of 137 per hour.



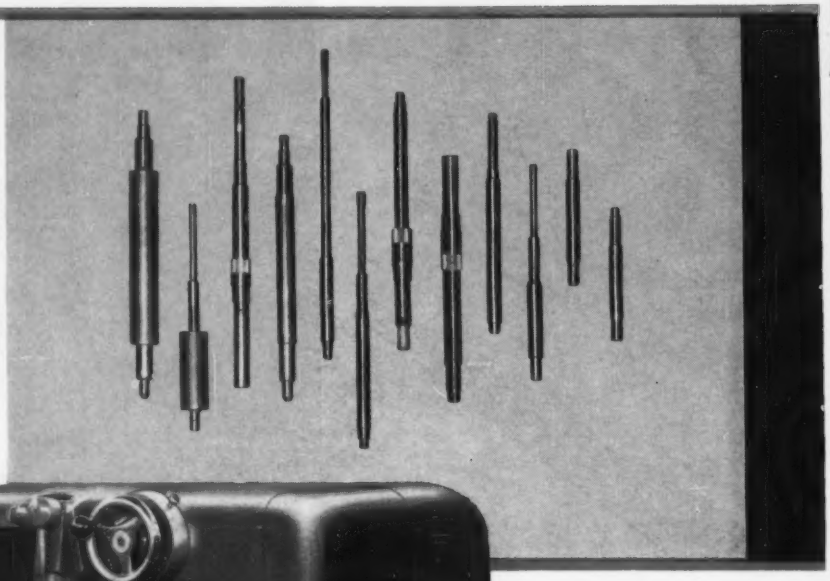
BROACHING MACHINES • COMPLETE PRODUCTION LINES

SPECIAL MACHINE DIVISION
The Cincinnati Milling Machine Co.
Cincinnati 9, Ohio

For more data, circle this page number on inquiry card

Accuracy and speed of Landis plain grinders

Since the addition of two Landis 4'' Plain Grinders in the grinding department of a midwestern electric company, overall grinding costs on motor shafts have shown an appreciable drop. Production has been stepped up and at the same time rejects have been substantially reduced. Close tolerances of .0002'' are easily maintained with finishes meeting all requirements consistently.



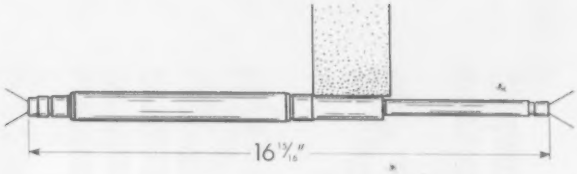
Landis 4'' x 18'' type H plain hydraulic grinder

LANDIS TOOL COMPANY

cut unit costs in grinding motor shafts

Profitable production. Fast change of setup on the new Landis Grinders means more production time. Twelve electric motor shafts of varying diameters are ground in this department.

Close tolerances. Accuracy to "tenths" consistently maintained on infeed and traverse grinding operations.

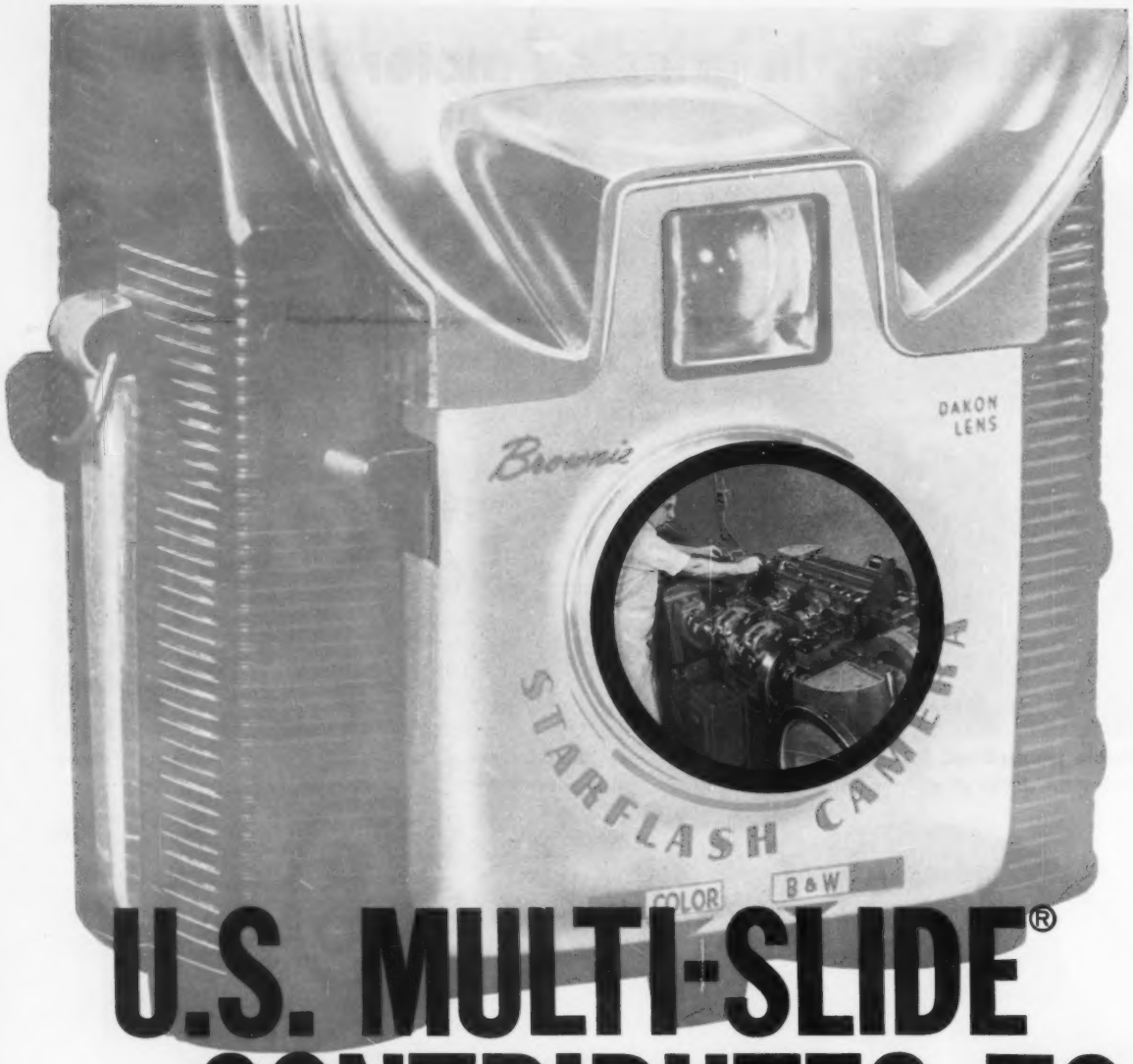


production data

Operation:	Infeed and traverse grinding diameters of motor shafts
Machines:	Landis 4" type H plain grinders
Production:	From 70 to 140 parts per hour depending on size
Material:	1117 cold rolled steel and free machining stainless steel type 416
Stock removal:	.012" to .015", finishing
Finish:	16 to 30 RMS
Tolerance:	Range from .0002" to .0005" on diameter depending on the shaft being ground

WAYNESBORO, PENNSYLVANIA

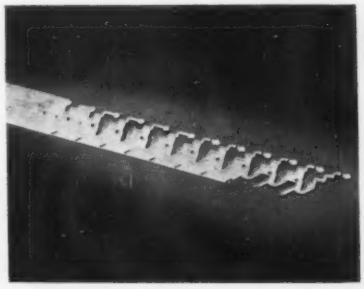
LANDIS
precision grinders

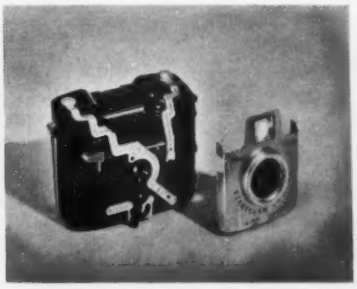


U.S. MULTI-SLIDE® CONTRIBUTES TO SUCCESS OF KODAK BROWNIE STARFLASH!

Manufacture of a reliable, practical camera, with a built-in flash, that will sell at a popular price calls for considerable engineering skill and technical know-how. It calls for good design and sturdy construction. It demands consistently accurate production — unwavering accuracy at high speeds.

Eastman Kodak Company has been using U.S. Multi-Slide Machines for many years and has found them satisfactory in high volume production of irregularly shaped parts. Parts are manufactured without intermediate handling or secondary operations that would have been required by conventional methods.





Presently, Eastman Kodak Company's Apparatus & Optical Division uses U.S. Multi-Slides for the production of no less than six parts for Brownie Star Cameras; the Starflash, Starflex and Starlet.

A Model #33 U.S. Multi-Slide is used to produce battery connectors for the Brownie Starflash. The machine is arranged with multiple rams and tooling with three separate die stages — producing a completed part at each cycle.

Because of their versatility, the U.S. Multi-Slides could be readily adapted by Eastman Kodak's A. & O. Division to manufacture other flat stock stampings, wire parts, or the simultaneous feeding and processing of more than one strip to complete an assembly. Prefabricated parts could be hoppered, positioned and assembled to the stamping being made in the machine.

Write today to find out how U.S. Multi-Slides can produce your stamped components better and more efficiently . . . ask for Bulletin #15M, or send in samples or drawings of the part you want produced.

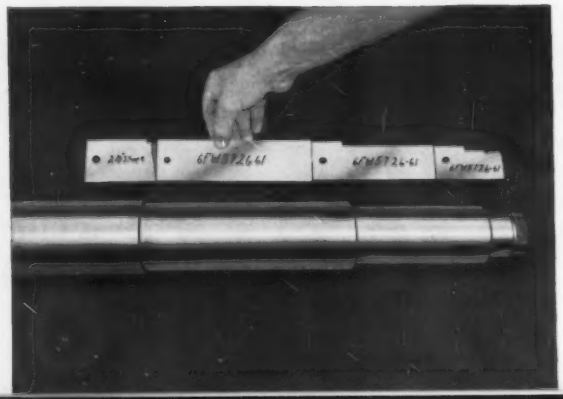
ILLUSTRATED OPPOSITE PAGE: The popular Kodak Brownie Starflash Camera . . . ABOVE: Left to right: Successive stages in the production of Brownie Starflash Battery Connectors as stamped by a U.S. Model #33 Multi-Slide . . . Brownie Starflash Camera disassembled (built-in flash removed) to show location of battery connector produced on a #33 U.S. Multi-Slide, part of flash synchronization circuitry . . . U.S. Multi-Slide Model #33 in use at Eastman Kodak Company's Apparatus & Optical Division in Rochester, New York. Machine is turning out battery connectors for the Brownie Starflash Camera.

U. S. TOOL COMPANY, INC. AMPERE (East Orange) NEW JERSEY

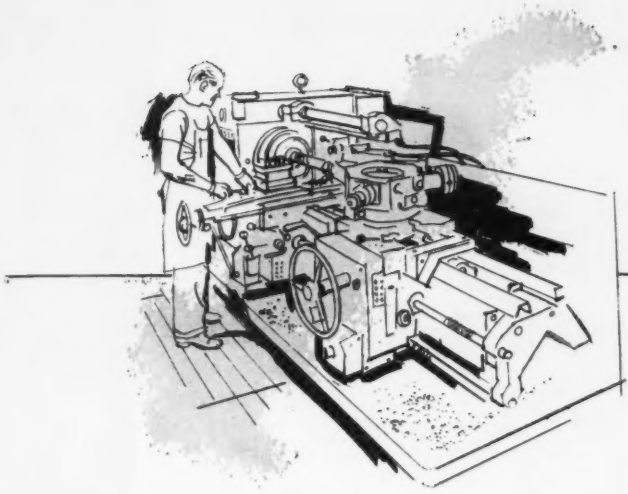
U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories

MULTI-SLIDE

For more data, circle this page number on inquiry card



Unique Section Template was one idea which Hobart tooling specialists came up with to reduce setup time and minimize template costs. A short template was made up to handle a range of shafts with similar ends. Various length middle sections could then be quickly inserted to obtain various lengths and shoulder locations. A three-section template is shown in use on the machine in upper photo. The interchangeability feature of the template sections is shown at left. Two pieces of this four-section template – the section marked "2⅛ Shaft" and the spacer section held in hand – are also used in the above setup.



AT HOBART BROTHERS COMPANY
TROY, OHIO

Warner & Swasey 2-A with contouring cross slide

- *Slashes setup time*
- *Combines auxiliary operations into one setup*
- *Produces shafts at 1948 cost levels*

HOBART BROTHERS CO.—a leading producer of arc welding equipment and aircraft ground-power units—faced a serious production bottleneck. Long setup time on their older turret lathes and excessive part handling time was crippling the small lot production of motor-generator shafts. Because their production scheduling for 77 different models of arc welders, 20 models of ground-power units, plus numerous specials, is tied directly to sales, lot sizes frequently had to remain small—usually from 1 to 20 pieces.

Hobart launched a three-pronged attack to solve the problem by:

1. Installation of a new Warner & Swasey 2-A Saddle Type Turret Lathe equipped with a hydraulically-controlled cross slide contour unit.
2. A creative tooling approach to reduce setup time.
3. A thorough time and motion study to insure efficient utilization of daily production time.

As a result, Hobart Brothers today are producing shafts at 1948 production costs!

Contributing to the success of this efficiency study and modernization program was their new contour cross slide equipped Warner & Swasey 2-A which permitted:

- **Setup time to be slashed—from 2 hours to 20 minutes.**
- **Combining of center drilling, facing and threading operations into a single, efficient turret lathe setup reducing part handling time.**
- **Production time savings averaging 35% because of higher horsepower and spindle speeds, and elimination of extra hex turret and square turret handling time. All diameters and grinding reliefs are produced directly from the template.**
- **Holding closer tolerances which reduced grinding time and extended grinding wheel life.**

Check today with your Warner & Swasey Field Representative. He'll gladly tell you how the cost-cutting results of the "Hobart Story" can be a reality on your own operations.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS...WITH A WARNER & SWASEY

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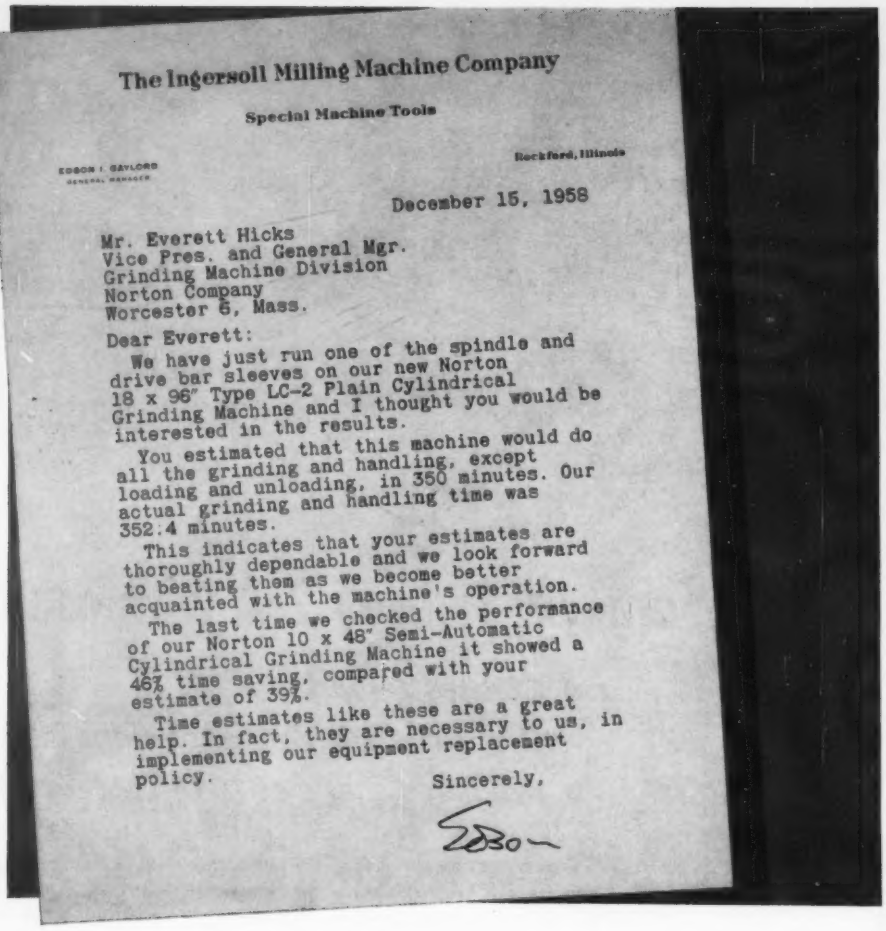


The Ingersoll Milling Machine Company

Special Machine Tools

EDSON I. GAYLORD
GENERAL MANAGER

Rockford, Illinois

December 15, 1958

Mr. Everett Hicks
Vice Pres. and General Mgr.
Grinding Machine Division
Norton Company
Worcester 6, Mass.

Dear Everett:

We have just run one of the spindle and drive bar sleeves on our new Norton 18 x 96" Type LC-2 Plain Cylindrical Grinding Machine and I thought you would be interested in the results.

You estimated that this machine would do all the grinding and handling, except loading and unloading, in 350 minutes. Our actual grinding and handling time was 352.4 minutes.

This indicates that your estimates are thoroughly dependable and we look forward to beating them as we become better acquainted with the machine's operation.

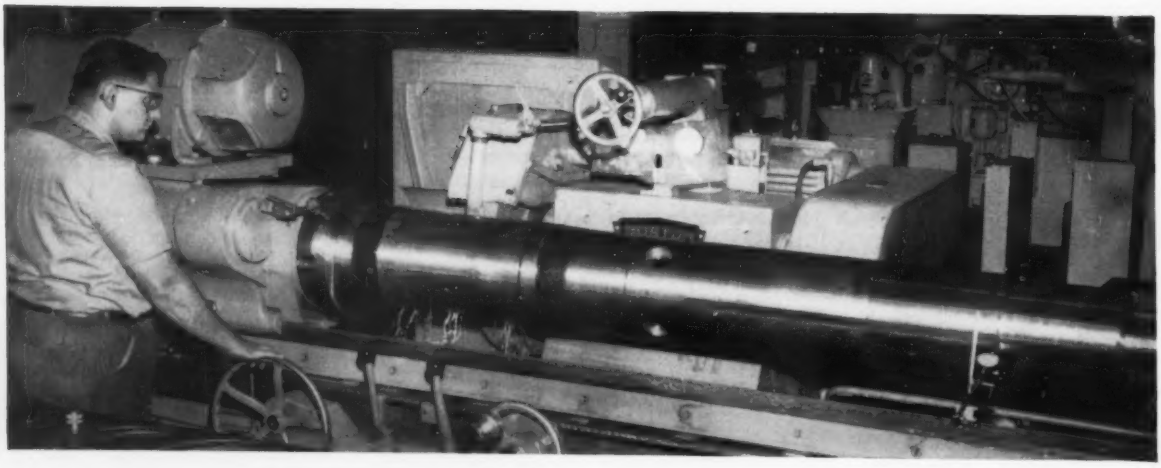
The last time we checked the performance of our Norton 10 x 48" Semi-Automatic Cylindrical Grinding Machine it showed a 46% time saving, compared with your estimate of 39%.

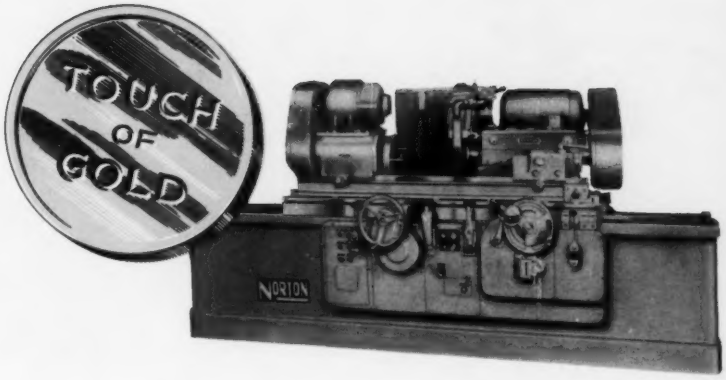
Time estimates like these are a great help. In fact, they are necessary to us, in implementing our equipment replacement policy.

Sincerely,

Edson

Ingersoll reports how Norton Cylindrical Grinders save





as predicted

As Mr. Gaylord, the Ingersoll Milling Machine Company's General Manager, points out, Norton machines will give you increased production.

This increased production is just one of the proved "Touch of Gold" advantages of Norton grinding machines. Others are precise sizing control, low maintenance and long, continuous service life. These are designed into each machine.

Norton Cylindrical Grinders have swing capacities ranging from 4″ to 24″ and work lengths from 18″ to 168″. All are available as Plain Machines or Semiautomatics. All have controls for feeds and speeds grouped at the operating position, with key maintenance points located outside. And all are engineered for adaptability to meet changing production requirements, and for durability to keep on delivering economy under the toughest conditions of use.

Call in your Norton Sales Engineer, a well trained, long experienced specialist in grinding. He'll gladly give you an accurate estimate of what Norton grinding machines can do for you. NORTON COMPANY, Machine Division, Worcester 6, Mass. District Offices: Worcester, Hartford, Cleveland, Chicago, Detroit. In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5.

Photos show the types of cylindrical grinders used and described by the Ingersoll Company. Photo at upper right is a Norton 10″ x 48″ Type CTU; photo at left was taken in the Ingersoll plant, and shows their Norton 18″ x 96″ Type LC-2.

NORTON

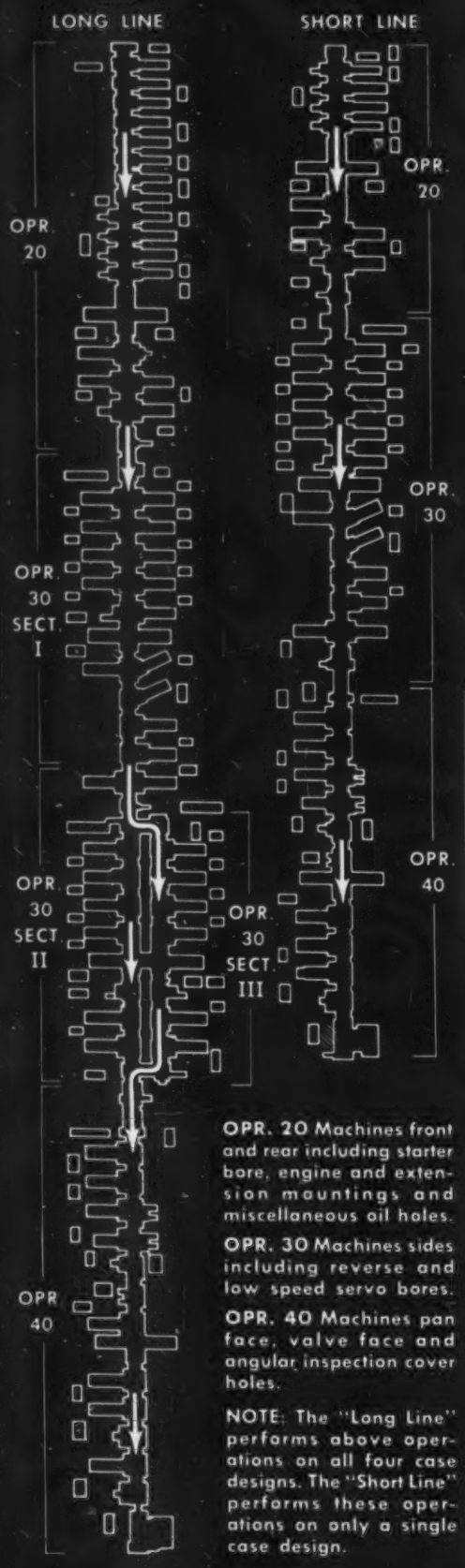
GRINDERS and LAPPERS

Making better products
...to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

For more data, circle this page number on inquiry card

Complete Product Mix Processed On New Cross Transfer-matics



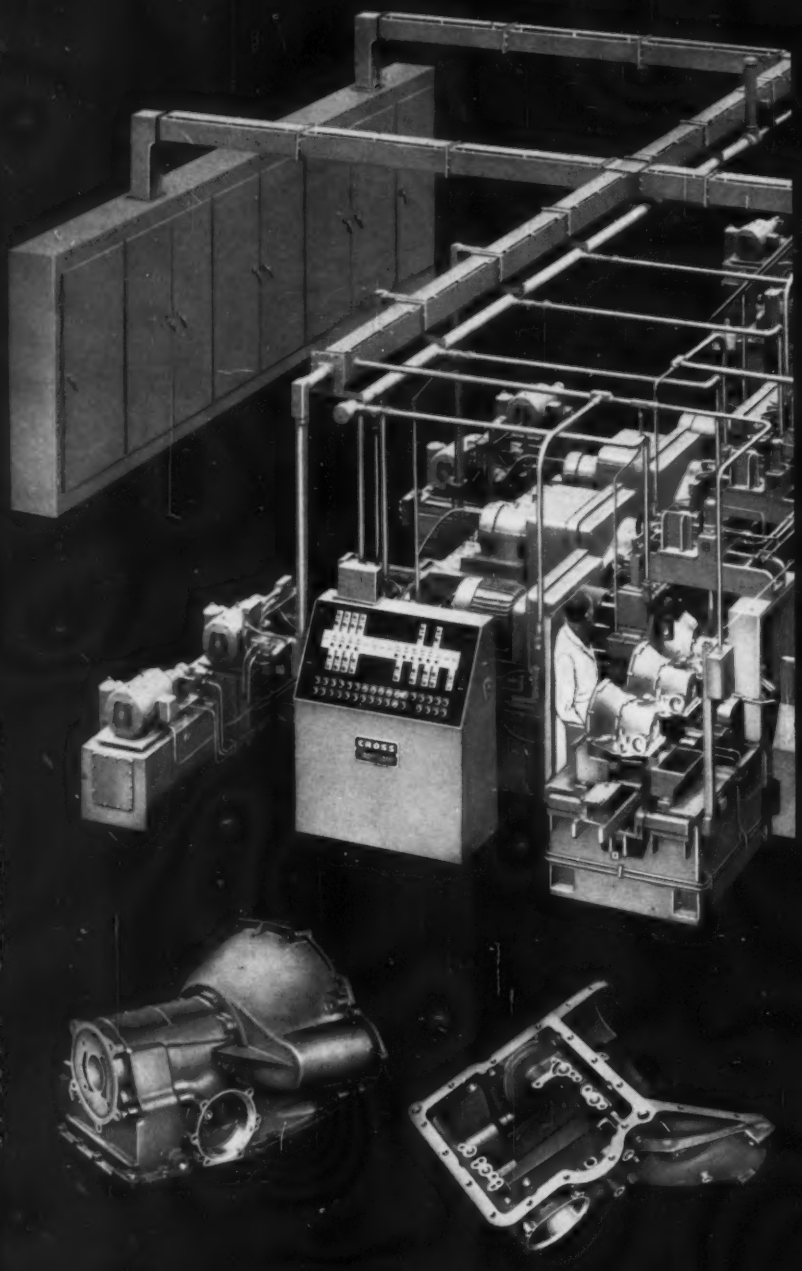
OPR. 20 Machines front and rear including starter bore, engine and extension mountings and miscellaneous oil holes.

OPR. 30 Machines sides including reverse and low speed servo bores.

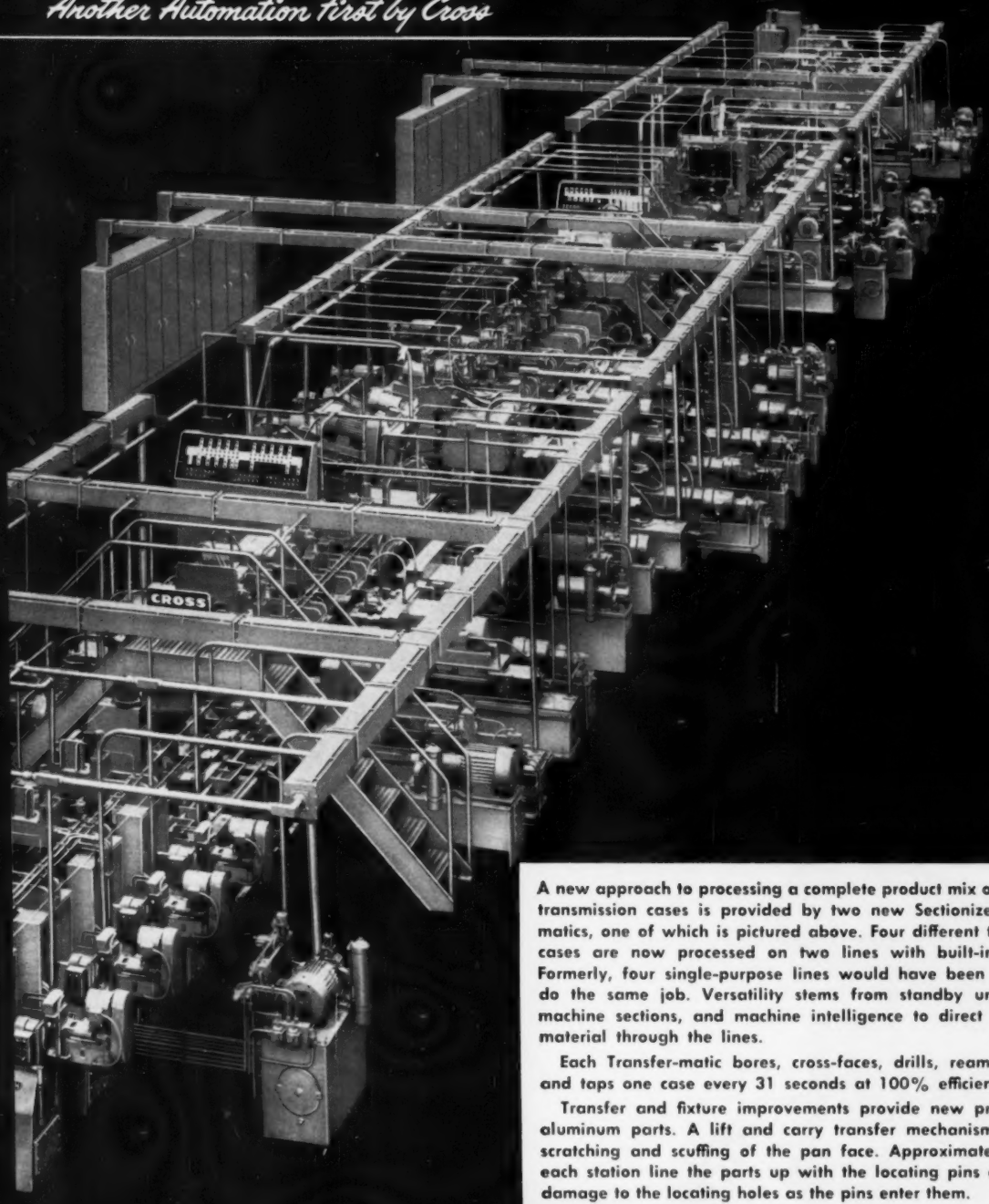
OPR. 40 Machines pan face, valve face and angular inspection cover holes.

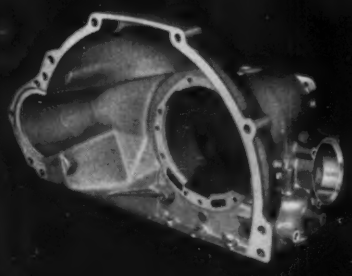
NOTE: The "Long Line" performs above operations on all four case designs. The "Short Line" performs these operations on only a single case design.

Floor Plan Layout of Two New Cross Sectionized Transfer-matics



Another Automation First by Cross





A new approach to processing a complete product mix of aluminum transmission cases is provided by two new Sectionized Transfer-matics, one of which is pictured above. Four different transmission cases are now processed on two lines with built-in flexibility. Formerly, four single-purpose lines would have been required to do the same job. Versatility stems from standby units, off-line machine sections, and machine intelligence to direct the flow of material through the lines.

Each Transfer-matic bores, cross-faces, drills, reams, chamfers and taps one case every 31 seconds at 100% efficiency.

Transfer and fixture improvements provide new protection for aluminum parts. A lift and carry transfer mechanism eliminates scratching and scuffing of the pan face. Approximate locators in each station line the parts up with the locating pins and prevent damage to the locating holes as the pins enter them.

Down time is minimized by use of "static" controls since conventional relay maintenance is virtually eliminated. Programmed tool changes with Cross Toolometers and Machine Control Units and a machine communications network facilitate "combined" tool and machine maintenance.

Sectionized machine design insures peak output by feeding parts into the machine behind "down sections."

The Cross "building block" principle and optimum standardization assure highest flexibility for part design changes or re-application of machine units for entirely new part processing.

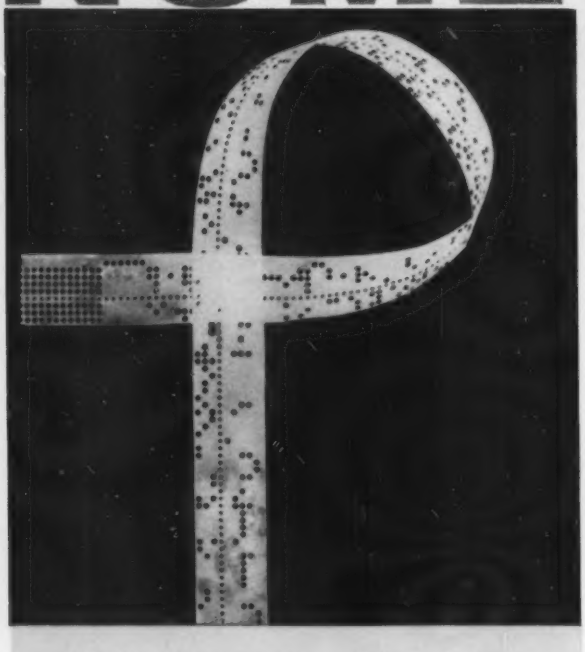
Established 1898

THE **CROSS** CO.

First in Automation

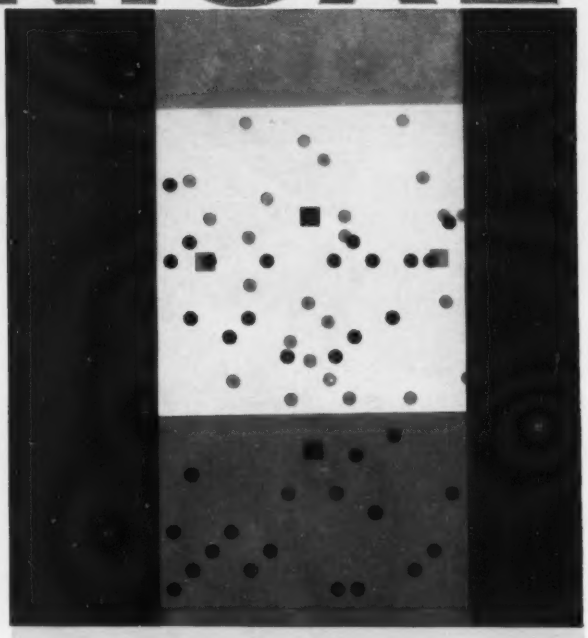
PARK GROVE STATION • DETROIT 5, MICHIGAN

NUMERICAL



1" 8-CHANNEL COMMUNICATIONS TAPE

Inexpensive, widely used throughout industry, these tapes may be prepared simply on a Flexowriter or similar equipment, usually by the Production Engineering Dept. Provides a typewritten record automatically for easy checking against pre-planned program.



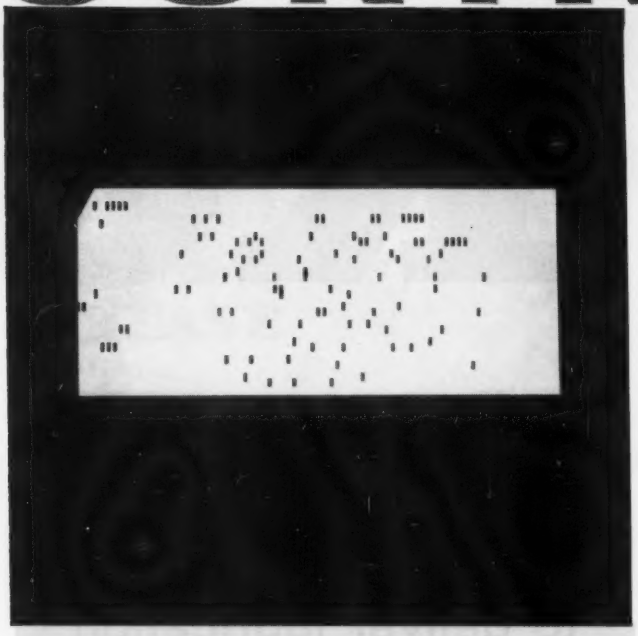
4" MYLAR PLASTIC TAPE

Least expensive of the generally accepted tape systems, particularly suitable for smaller shops machining parts with relatively few holes. Tape can be prepared easily by shop personnel.

1" 8-CHANNEL COMMUNICATIONS TAPE

4" MYLAR PLASTIC TAPE

CONTROL



PUNCHED CARDS

This system can be integrated with card systems already in use by your company. Each job is programmed in a "deck" of cards; provides great flexibility, since an operation can be added or eliminated simply by making a new card or removing an old one.

for Fosmatic JIG BORERS and JIG GRINDERS

Any tape or card reader can be used to control a Fosmatic Jig Borer or Jig Grinder. And because the functions of the standard Fosmatic are actuated electrically, numerical control can be installed in the field—economically!

Speeds and feeds are changed by controlling electro-magnetic clutches through relay contacts. Table and saddle position is determined by a measuring system actuated by direct reading dials. For numerical control, these dials are driven by a fractional hp motor.

On a Fosmatic, you can program as many functions as you wish. Table X and Y positions (to .0001"), Feeds and Speeds, Spindle start and stop, Spindle feed start and stop, Spindle feed depth, Spindle head height, Automatic tool change. And only Fosmatic gives you a visual numerical check of coordinate location plus operation sequence number.

Example of savings made with Fosmatic numerical control. The illustration (left) shows one half of a mold with 900 cavities, each of which requires nine operations—a total of 8100! Time for the entire job was 100.25 hours, 25% of time consumed previously on a conventional jig borer.

Write or call today for complete information on a numerically controlled jig borer or jig grinder to improve your production method.

PUNCHED CARDS

Buy a Fosmatic today—add Numerical Control tomorrow

For more data, circle this page number on inquiry card

How

RYKO

In just two years since introduction, **RYKON** Grease has stepped in to deliver lubrication in hundreds of applications where other greases have failed

The reason RYKON Grease can perform under conditions that cause other greases to fail is this: RYKON Grease has a unique non-soap, organic thickener. This thickener holds the oil between its fibers better than any other gelling agent. The thickener is able to withstand extremely high as well as low temperatures. It resists chemical action and remains stable under conditions of severe working and water washing. RYKON Grease has exceptional anti-rust properties.

RYKON Grease's unique properties make it truly multi-purpose. This leads to many worthwhile economies. With one grease to do possibly every grease lubrication job in a plant, there's no chance for application mistakes. Inventory and handling of many single-purpose greases is reduced or eliminated. Maintenance training and supervisory follow-up is greatly reduced.

More facts about RYKON Grease are yours for the asking. Call the lubrication specialist in your nearby Standard Oil office in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 S. Michigan Ave., Chicago 80, Illinois.**

N GREASE

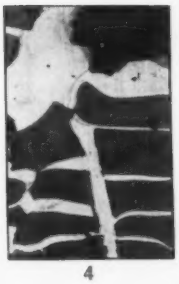
has performed in ten tough applications

High temperature test for grease. Grease samples are spread on metal strips and placed in 350° F. oven for five days. Only RYKON Grease remained workable at end of test.

1

2

3



4

In the metalworking industry, where higher speeds, loads, temperatures and pressures are being put on bearings as a means of increasing productivity of equipment, a new type of grease has been needed. RYKON is that grease. Here are just 10 examples of how RYKON Grease has performed in tough spots:

Industry	Equipment	Type of Bearings	Conditions	Remarks
Steel Mill	various	plain and anti-friction	high temperature, heavy load, water, dirt	Outperforms all previously used greases. Less consumption, fewer bearing failures.
Steel Mill	tin line	plain and roller	high temperature, water	Hot caustic water caused other greases to run out and form deposits. RYKON lasts twice as long.
Metalworking	bearings over molten pot	—	high temperature	Temperature reaches 500° F. at times. RYKON stays in longer.
Steel Mill	pit crane, floor crane, charging car	plain and anti-friction	high temperature	Lasts twice as long as some other greases used.
Metalworking	drill head multi-spindle	anti-friction	heavy load	Other greases failed. Running cool on RYKON. No leakage.
Auto Manufacturer	switches on machine tools	—	wet	Good water protection and dielectric strength at a lower cost than previously
Die Caster	die cast machines	various	high temperature	Cut down wear considerably.
Bearing Manufacturer	high speed spindle bearings	anti-friction	high temperature, heavy load	Lasts twice as long as a high priced bearing grease. Does not darken or form varnish.
Steel Fabricator	core oven conveyer	pulley bearings	high temperature and dirt	Works where other greases ran out. RYKON best ever used.
Steel Fabricator	oven conveyer	ball	high temperature	All previous greases caused trolley bearings to stick. RYKON solved problem.

Oven test shows high temperature performance of RYKON Grease. 1. Metal panel coated with RYKON and placed in oven at 350° F. 2. Same panel after five days. RYKON is still soft and ready to lubricate. 3. Another high-melt grease ready for same test. 4. Same panel after oven test Grease has failed completely.

You expect more from **STANDARD** *and you get it!*

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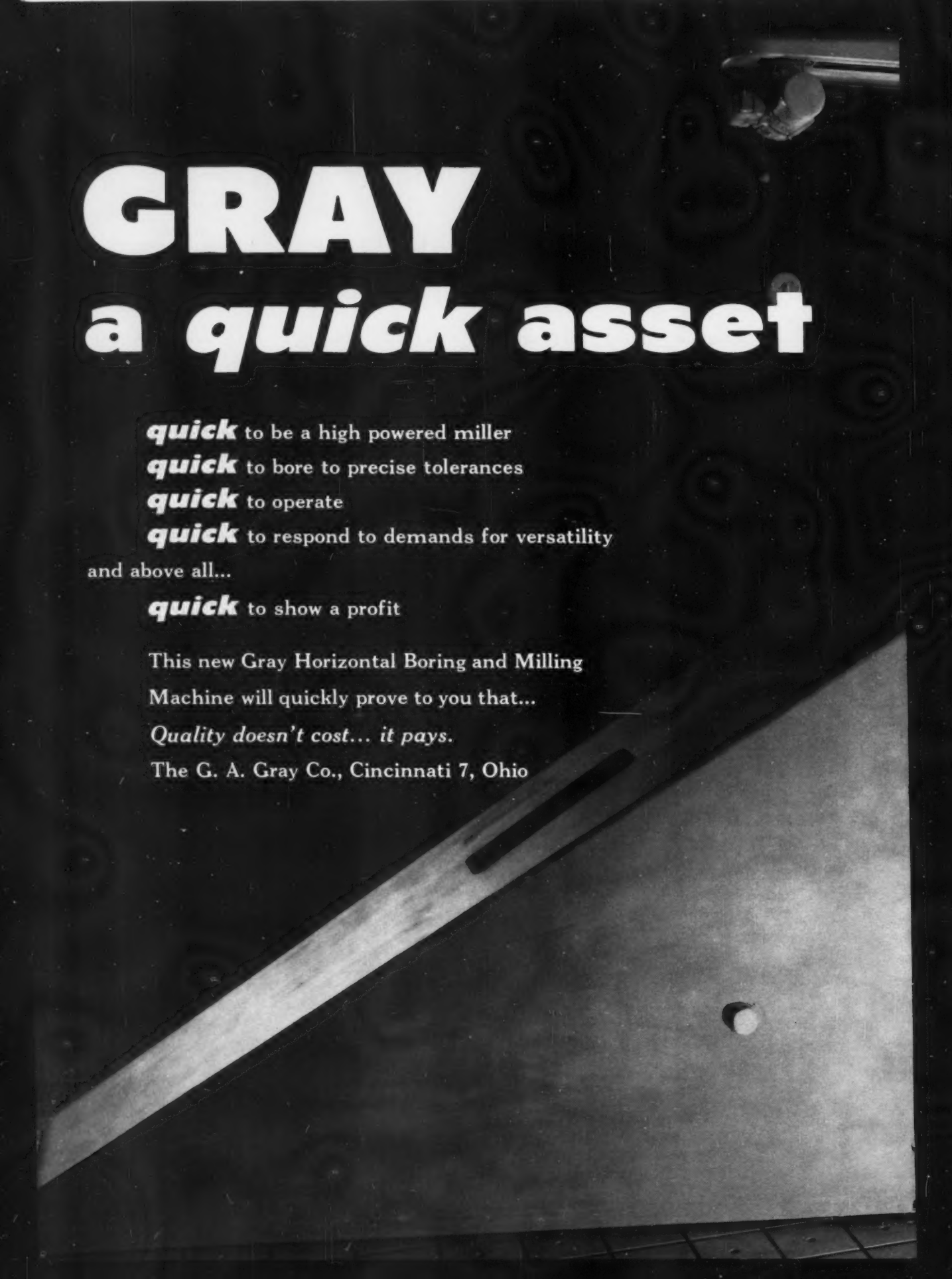
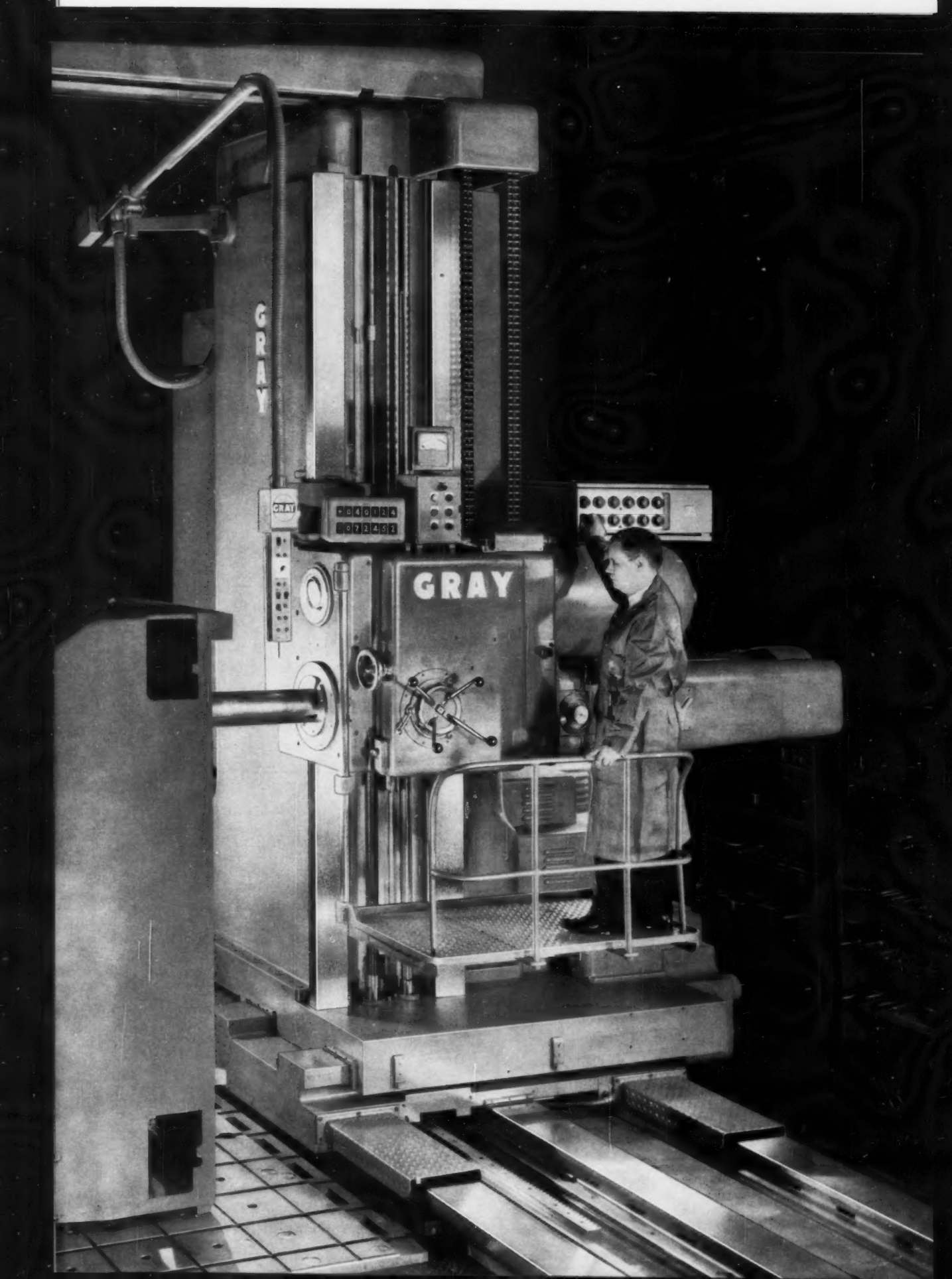

GRAY
a quick asset
quick to be a high powered miller
quick to bore to precise tolerances
quick to operate
quick to respond to demands for versatility
and above all...
quick to show a profit
This new Gray Horizontal Boring and Milling
Machine will quickly prove to you that...
Quality doesn't cost... it pays.
The G. A. Gray Co., Cincinnati 7, Ohio


GRAY
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+040124
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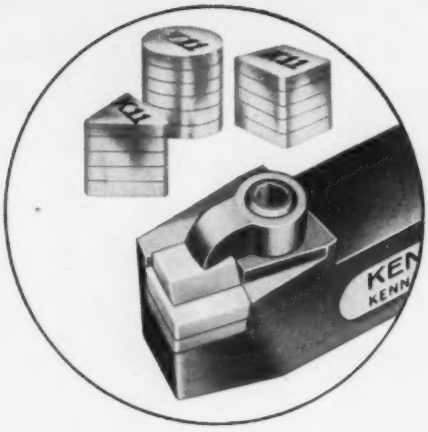
KENNAMETAL* K11



A specialty grade in 1955 ... a production grade today

Created four years ago to provide the greatest possible resistance to abrasion, K11 soon demonstrated exceptional performance in finishing and light roughing of cast iron, alloyed cast iron, brass, bronze, and light alloys. Today, under certain conditions, K11 is also being used for light cuts on steel, as well as for machining unfired ceramic materials, resin materials, and plastics.

Having a hardness of 93.0 Rockwell A, K11 has been found particularly suitable for such precision operations as boring brake drums, machining cam shafts, finishing pistons and sleeves. It is also recommended for die inserts for compacting ceramics, abrasive wheels and other applications involving severe abrasion.

Here are a few examples of K11 "success" stories from many varied applications:

A. Turning SAE 1213 steel rotors . . . At 298 sfm (2550 rpm), K11 increased pieces per insert from 750-1000 to 7500-9000.

B. Machining cast iron . . . K11 averaged 11.7 pieces with .008″ wearland. Closest competitive carbide could produce only 9.7 pieces with .016″ wearland. Considering rate of wear, K11 performance represents a 3 to 1 improvement.

C. Machining Fiberglass missile parts . . . on tests K11 provided 15% greater tool life than the best of three other makes of carbides. K11 has been used continuously on this job for over a year.

D. Finish facing modular iron flywheels . . . K11 increased output from 30 to an average of 100 pieces per cutting edge.

E. Boring welded bracket of 1020 steel . . . K11 is producing 70% more pieces per cutting edge at 100 sfm, .020″ depth and .002″ feed.

K11 is now available from stock ... at stocked grade prices

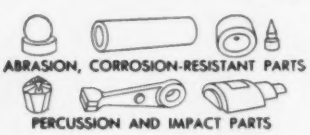
Due to outstanding performance on these and many other difficult jobs, demand for K11 has increased rapidly. To meet this growing popularity, K11 inserts are now available from stocks at Kennametal plants in Latrobe and Detroit. Triangular, square and round inserts with negative rake; also square and triangular inserts with positive rake are being stocked and are available at stocked grade prices, Group II.

For more information about this hard Kennametal grade, see your Kennametal Representative or write KENNAMETAL INC., Latrobe, Pa.

*Trademark

ST62

INDUSTRY AND **KENNAMETAL** ...*Partners in Progress*



versatility:
precision grind TWO parallel surfaces of widely varying parts in ONE operation

Gardner 2H30
precision double spindle grinder

Send prints of your parts for a Gardner proposal and request new general catalog.

GARDNER
precision disc grinders
BELOIT, WISCONSIN

BERTHIEZ has been
CUTTING BOTH WAYS,
COMING AND GOING for
the last 12 years
BERTHIEZ has been rough and finish
CUTTING BOTH WAYS with
multiple tools for the last 10 years

BERTHIEZ has supplied over 100 large Single and Double Upright Planers CUTTING BOTH WAYS, COMING AND GOING since 1946 which have been working year in and year out ON DOUBLE WAY CUTTING

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HEAD OFFICE, 5, RUE MONTALIVET, PARIS (FRANCE)

QSA

Motch & Merryweather's

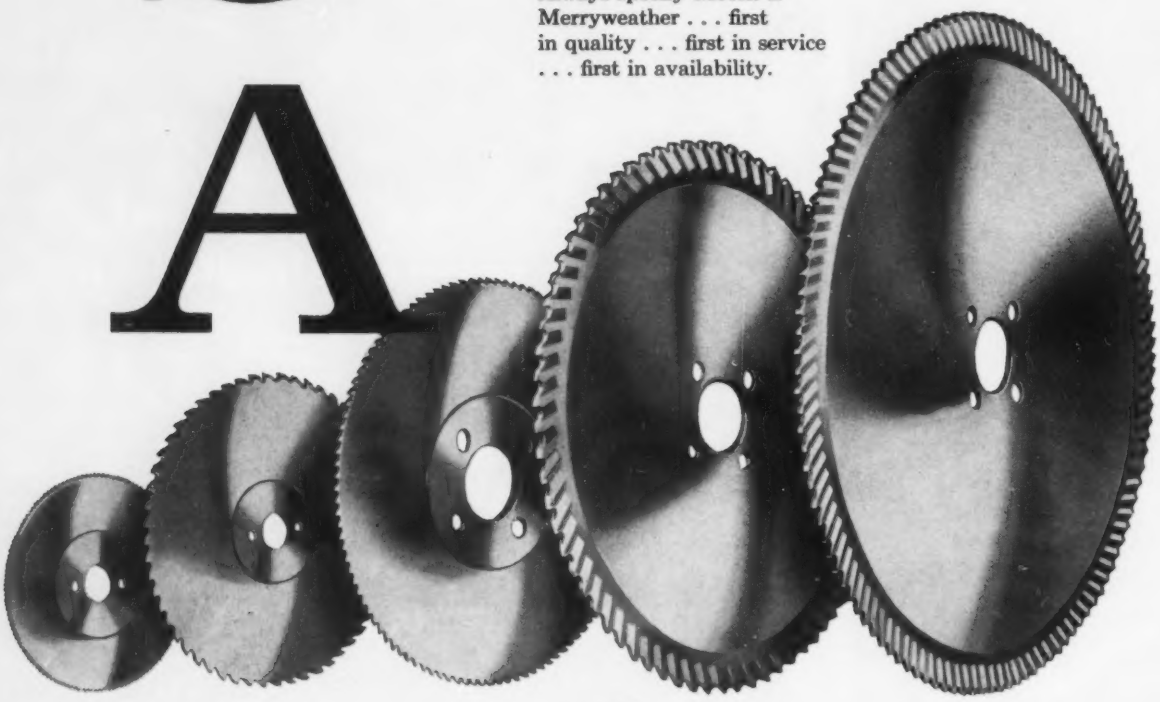
Quality, Service and Availability add up to lower production costs

Triple Chip cut-off blades and slitting saws—characterized by a specially-developed tooth form—cut faster and last longer.

M&M's factory repair, resharpening and resegmenting service, the fastest in the industry, helps you avoid excessive inventories . . . minimizes costly downtime.

The complete line of M&M cutting tools, stocked by M&M distributors strategically located in every important industrial area, enables you to get immediate delivery on the tools you need, when you need them. Sawing and cutting tool specialists are always available to help you solve tough or unusual sawing problems.

Always specify Motch & Merryweather . . . first in quality . . . first in service . . . first in availability.



FREE—*Send today for your copy of M&M's Circular Sawing Handbook, a pocket-sized guide to sawing operations.*

THE MOTCH & MERRYWEATHER MACHINERY CO.

Cutting Tool Manufacturing Division

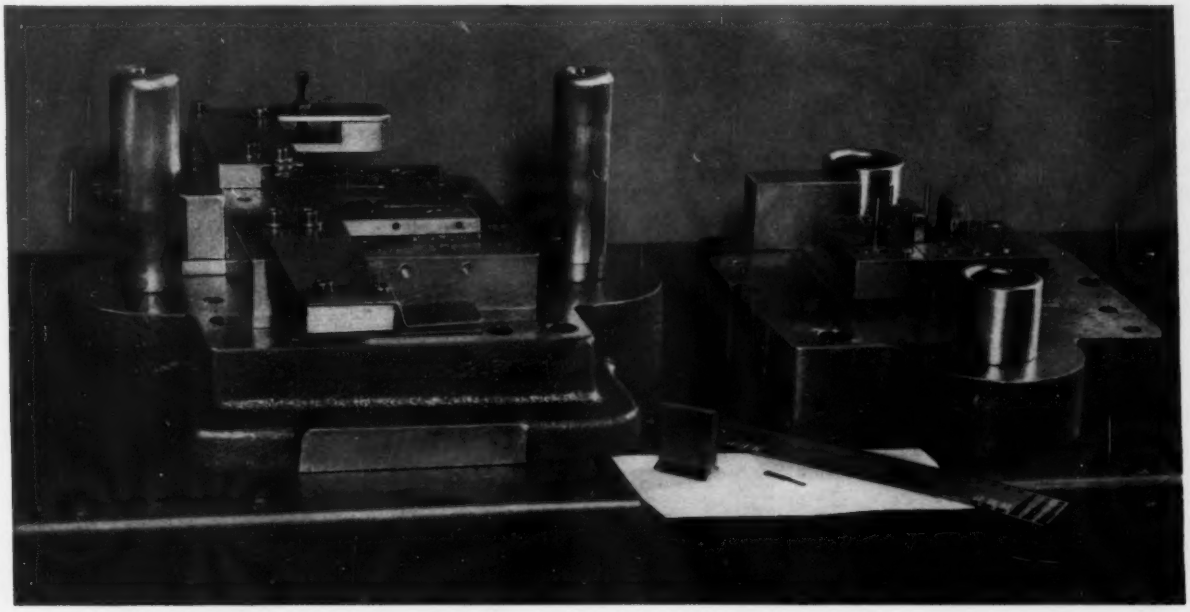
Cleveland 17, Ohio

Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export Distributor: Bethlehem Steel Export Corporation



Blanking Die Output Doubles When Bearcat Takes Over

At the Remington Rand Division of Sperry Rand Corp. they were getting up to 50,000 pieces from a set of dies that blanks and forms grooved pins from .025-in. steel strip. Our local tool steel distributor, Leed Steel Co., suggested a change to our Bearcat tool steel. Result? The output increased to about 100,000 before the die needed reworking.

Bearcat has exceptional resistance to wear and shock. Because of its air-hardening characteristic, Bearcat minimizes quenching hazards and distortion in heat-treatment.

WIDE RANGE OF APPLICATIONS

In addition to blanking and forming jobs, Bearcat can be used economically in such varied applications as shear blades, punches, rivet sets, hot headers, die-casting die inserts, and master hobs. In fact, wherever the job calls for a grade having unusual toughness, Bearcat is the answer.

Your Bethlehem tool steel distributor carries Bearcat in stock in a wide size range. He's ready to serve you at a moment's notice. Give him a call today.

←Memo to Die-Casters:

USE CROMO-HIGH V (H-13)

You can't go wrong when you choose Bethlehem Cromo-High V (AISI-SAE H-13) for die-casting. This 5 pet chromemoly grade, with 1 pet vanadium, has good resistance to wash and erosion, plus plenty of toughness. It's uniformly annealed, for easy machinability. It also has good center density and grain refinement, and is free from porosity.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Periodic Regrinding Improves Tool Life

The service life of many types of tools can be improved if the tools are periodically reground at intervals before they have deteriorated to a degree which impairs their function.

This practice is particularly useful when applied to tools which repeatedly fail in service by fatigue, chipping, spalling, or cracking through heat checks. The objective of preventative grinding is the removal of service-damaged metal before the damage progresses to a depth which would not be removed in normal redressing operations. It is an application of the old proverb, "A stitch in time saves nine," and is just as appropriate when applied to tools as to a small rip in a piece of wearing apparel.

The point at which regrinding should be done during the service of a given tool must be developed by experimental work. It is most practical if it can be made to coincide with a normal shutdown of an operation for other reasons.

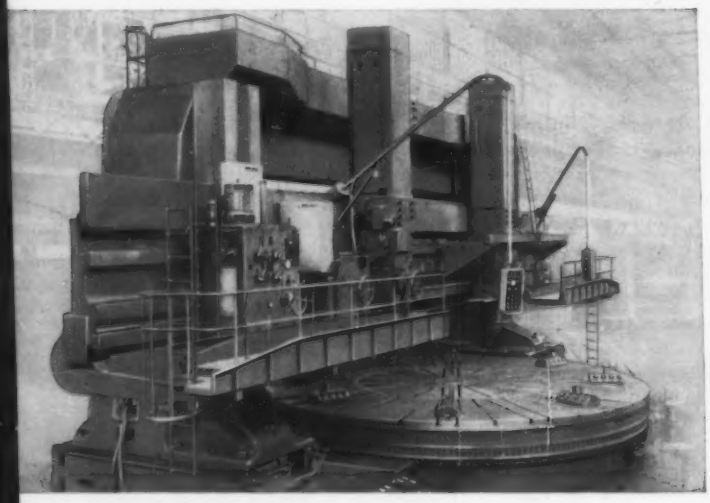
watch these giant workers chip away costs!

This 8⅞ in. SCHIESS model BF horizontal boring and milling machine . . .
now completely redesigned with many innovations. Here are a few . . .

Two individual drives—gear-drive for roughing, belt-drive for finishing. Belt-drive particularly suited to high-speed machining with carbide tools. New tool clamping device—does away with draw keys, hammers, drifts and binding screws. All spindle-slide movements controlled from easily accessible operating platform (or from pendant station or portable control panel, if desired). Special main-drive belt requires no readjusting. Column, spindle-slide and boring spindle may be adjusted at rapid traverse.

Spindle diameters, 6-5/16″ to 8-7/8″. Maximum diameter bored, 59″—faced, 79″.

It takes Europe's largest builder of heavy machine tools, Schiess, to turn out giants like these. Parts and service as close as Pittsburgh. And an American Schiess engineer will be happy to help you size up these heavy producers for your heavy production needs. Write for catalogs and complete specifications on all Schiess BF and K models.



This 32 ft. SCHIESS model GK vertical boring and turning mill . . .
Look at all these new features of the most modern vertical boring mill of its type: Two ram heads on the rail, one of which is tracer-controlled. One milling head on the rail which can be parked on the left side rail extension. Dual tables—one 15′ table on the inside, a 32′ table on the outside. Each table has independent drive, or both tables can be used together and synchronized as one. Table equipped with indexing device to be used for indexing layout work. Machine will swing a maximum diameter of 40′. Rapid traverse motions with pushbutton control of changeover from feed motion to independent power traverse. Electro-mechanical locking of cross-rail to columns. Fingertip speed control—counter-balanced cross-rail and side-head—completely enclosed swiveling octagon rams—pendant control—automatic lubrication.

Have you ever seen anything like it?

SCHIESS

AMERICAN SCHIESS CORPORATION

1232 Penn Avenue, Pittsburgh 22, Pa.

PLANING + MILLING

of Heavy Workpieces in one set-up . . . on one machine

- Reduces machining time
- Reduces set-up time
- Increases over-all accuracy
- Cuts manufacturing costs

Write for details

Waldrich Siegen combined planing and milling machines

WALDRICH SIEGEN

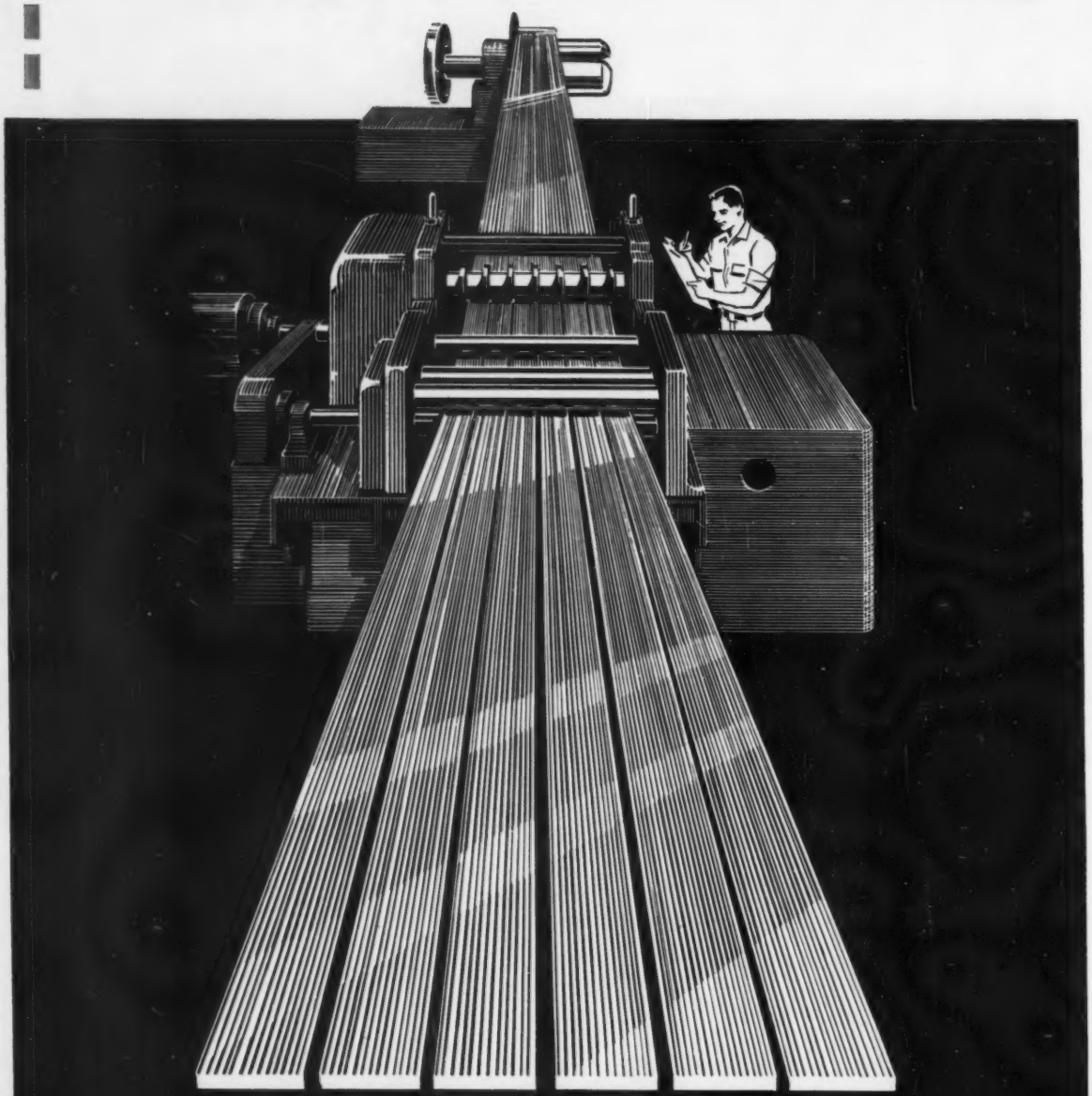
american waldrich mfg. corp.

1232 PENN AVENUE, PITTSBURGH 22, PENNSYLVANIA

YODER

Rotary Slitters—Product dependability—integrity of manufacture—engineering for specific production needs have all contributed to establish Yoder equipment as the industry standard of excellence. Since 1909 Yoder-built machinery, including Pipe and Tube Mills, Roll Forming Equipment and Rotary Slitters, have earned world-wide customer satisfaction and recognition. Profit from Yoder's years of engineering and service experience. Send today for the illustrated Yoder Slitter Book.

THE YODER COMPANY • 5504 Walworth Avenue • Cleveland 2, Ohio



ENGINEERING
YODER
MANUFACTURING

ROTARY SLITTING LINES

PIPE AND TUBE MILLS (ferrous or non-ferrous)
COLD ROLL FORMING MACHINES

POSITIVE DUPLICATION – EVERY TIME!

(PD) ° Distinctive bullet markings occur every time a bullet leaves the same gun barrel. The barrel rifling grooves the slug, making possible *positive identification*—an important contribution to the science of ballistics.

WHEELS MATCHED TO MACHINE

Just as a bullet is matched to a gun barrel, so CINCINNATI (PD) CENTERLESS WHEELS (like those shown above) are matched to your centerless grinding jobs. Thirty-five years of centerless grinding experience back up each application of CINCINNATI (PD) WHEELS to your operation.

PRECISION PERFORMANCE

And every time—time after time—when you reorder a CINCINNATI (PD) WHEEL, it will act and grind exactly like the original. The Positive Duplication of wheel grades by the remarkable (PD) manufacturing process *will help maintain your production*—and save you both time and money.

Whatever CINCINNATI (PD) WHEEL you specify . . . centertype, centerless, internal, surface, toolroom, or snagging wheel . . . you get Positive Duplication—every time!

APPLICATION BY SPECIALISTS

Here's another advantage for you. Each one of our factory representatives is a highly trained and experienced specialist in grinding machine set-ups and operations. For his help on those extra-tough grinding problems, call your CINCINNATI (PD) GRINDING WHEEL distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, Ohio.

(PD) POSITIVE DUPLICATION

CINCINNATI°

GRINDING WHEELS

° Trade Mark Reg. U. S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

For more data, circle this page number on inquiry card

The Norton Measure of Value . . . the true measure of savings on materials you buy for your production is the cost-per-piece produced.

Call your Norton Man — he has the experience, the products, and knows how to save you money where it counts. There's a Norton expert in the fields of — abrasives . . . grinding machines . . . refractories.

You can produce greater savings than you can buy

The economic truth of the above statement applies to all manufacturing and is especially true in grinding wheels.

There are less expensive grinding wheels than Norton wheels — and on the invoice they may look like a bargain. But if the wheels purchased fail to perform efficiently on the production line or incur production delays because of poor quality or misapplication — a higher cost of production is the price actually paid.

In brief, *the true measure of grinding wheel value is not how much you paid for it — but how much you get from it. Here is what you can get from Norton* —

Norton Company gives you the most advanced research engineering and manufacturing facilities in the entire abrasive field — and you get this great scope of detailed knowledge on a personal basis — your Norton Man.

Your Norton Man starts his career by spending a minimum of 1 year in a carefully planned training course in the Norton plant and a comparable period of training in the field. The Norton Man has an average of 15 years abrasive experience in addition to the specialized training. He is the most knowledgeable man in abrasives that you can consult. He is your consulting abrasive engineer.

He will make a free Abrasive Requirement Study for you. This study lists the correct specifications for each abrasive job in your plant to assure you lowest cost-per-piece produced. He is also available for complete field testing on specific problems.

For example, your Norton Man can increase production by pointing out ways to better wheel usage and fewer wheel changes. He has the widest selection of grinding wheels in the industry to help him select the perfect wheel for new product grinding operations and improving your current grinding jobs — both at the lowest cost. And with Norton grinding wheels you can be sure of precise duplication order after order.

Norton offers true abrasive economy. Economy that pays off in lower cost-per-piece produced. Call your Norton Man. NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

W-1891

NORTON

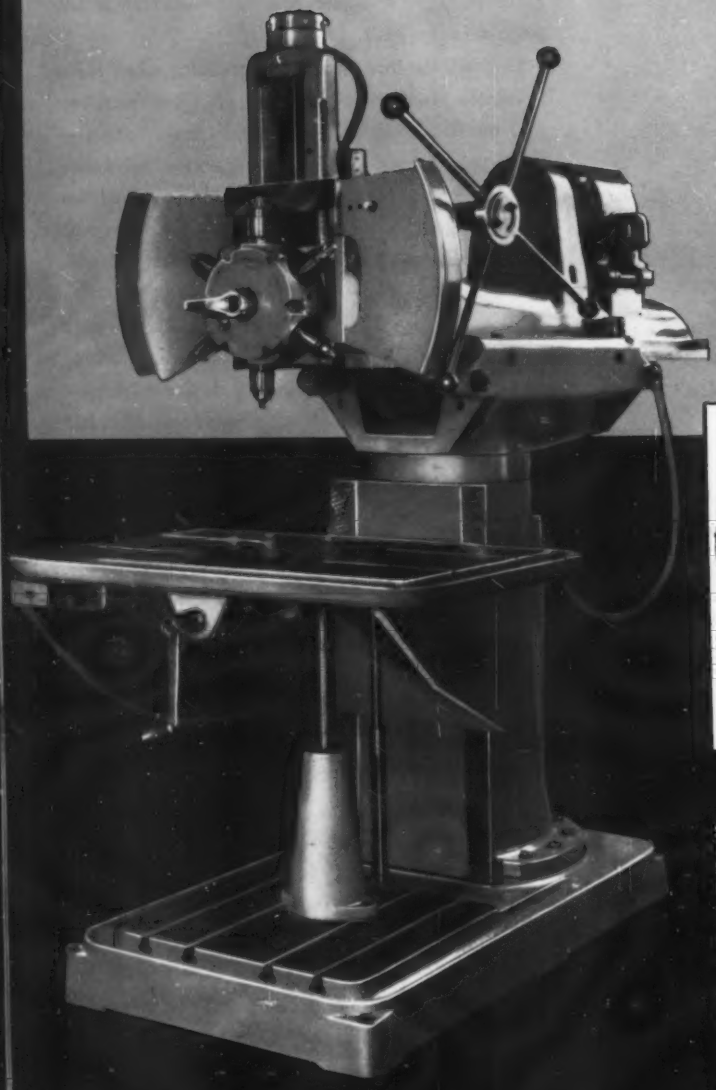
ABRASIVES

MAKING BETTER PRODUCTS TO MAKE YOUR PRODUCTS BETTER

For more data, circle this page number on inquiry card

300% Increase in Drilling Production

BURGMASTER 6-SPINDLE



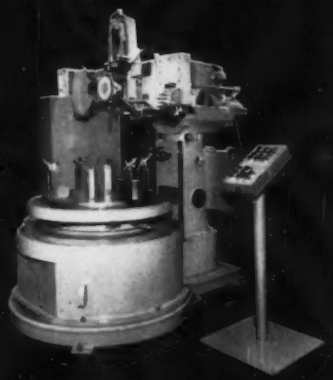
The use of six Burgmaster 6-spindle radial drills for machining of TERRIER MISSILE components has increased drilling, reaming, tapping and counterboring of complex parts in the Convair-Pomona operated facility by approximately 300% as compared to 4 or 6 spindle table drills. This substantial increase has been determined from an analysis of sixteen individual parts. These savings will result in the amortization of the equipment in 2.04 years.

The radial turret drilling machines have simplified the multiple drilling operations by fast precision indexing of the multiple tooled turrets. Tool settings and cutting sequences are consistently and accurately repeated at maximum speed to realize substantial savings in operation time. On the hydraulic manifold alone a total of 96 operations is performed using ten different tools. Dimensional consistency and closer tolerances are achieved by the complete mechanization of the machining sequence.

RAM MOVEMENT LAYOUT
PLAN VIEW

250° Radial Movement. The radial drill sweeps a radius of 14" minimum to 42" maximum through 250° over a 24" deep x 36" long table. The ram rolls on large double row ball bearings and is easily controlled by one hand from the handle on the turret. A press of the thumb releases the air hydraulic clamping of the ram and cradle, permitting free and easy movement of the ram in any direction. Releasing the button clamps all units rigidly in place, after which the spindle can be advanced to perform a precision operation.

Special Automatic Hydraulic Radial Turret Drills can be built up from Standard Components and supplied as complete production units including Tools, Fixtures, and Hydraulic power. The machine automatically carries out a complete cycle of operations including approach and return of each tool, and indexing on any desired set of circular or radial centers. The flexible machine has adjustable stops and controls which permits fast set-ups for machining a variety of parts.



Specialists in High Production Turret Drilling

"0" Manual
Power Index
¼" Capacity

1C Manual
Power Index
⅜" Capacity

2B Manual
Power Index
⅝" Capacity

2BF Flange Mounted
Power Index
¾" Capacity

2BH Automatic
Hydraulic
¾" Capacity

3BH Automatic
Hydraulic
1½" Capacity

2BR Ram Type
Radial Drill
¾" Capacity

2BHT-3BHT Automatic
Tape Controlled
¾" and 1½" Capacity

Pays for Equipment in 2.04 Years with
RADIAL TURRET DRILLS

Simplicity and Ease of Operation

The simplicity and ease with which the Burgmaster Radial Drill can be moved from one center to another, together with the 6-spindle automatic indexing turret which carries out a pre-planned sequence of operations, accounts for the savings. The turret is counterbalanced by an adjustable coil spring to make the turret weightless or for self returning to the top of stroke position. The machines have preselected spindle speeds varying from 125 RPM to 3000 RPM which permits operation at the most efficient speed for accuracy, finish, production and longest tool life. Accuracy is further assured by air hydraulic clamping of the ram slide and cradle, automatic turret clamping, and rigid micrometer depth control.

The advantages of this new method of machining Terrier Missile Manifolds can be further visualized when listing the various operations required, as follows:

No. of Operations	Operations
24	Drill .2190 / .2173 dia. x .61 / .58 deep.
24	C'Sink 100° x .270 dia. Tap ¼-28 UNF-2B x .38 deep, min. perf. thds.
8	Drill .198 / .204 dia. x 1.015 max. depth. C'Sink 100° x .271 dia. Tap ¼-20 UNC-2B x .65 deep, min. perf. thds.
1	Drill .241 / .248 dia. x .580 deep. Ream .252 / .248 dia. x .540 deep.
8	Chamfer 45° x .030 deep.
4	Drill .391 / .374 dia. x 1.38 deep at 15° angle.
4	Drill .391 / .374 dia. at 30° angle to break thru. (56 deep ref.)
3	Drill .155 / .145 dia. x .600 deep. (max.).
4	Drill .155 / .145 dia. x .72 deep (max.). C'Sink 100° x .208 dia. Tap 10-24 NC—2B x .430 deep, min. perf. thds.
2	Drill .391 / .374 dia. thru.
1	Drill .343 / .338 dia. thru at 75° angle.
2	Drill .114 / .102 dia. x .91 deep (max.). C'Sink 100° x .168 dia. Tap 6-32 NC—2B x .35 deep, min. perf. thds.
3	Drill .206 / .196 dia. x .61 deep. (max.). C'Sink 100° x .273 dia. Tap ¼-20 NC—2B x .38 deep, min. perf. thds.
4	Drill .206 / .196 dia. x .80 deep C'Sink 100° x .30 dia. Tap ¼-20 NC—2B x .50 deep, min. perf. thds.
4	Drill .7037 / .6959 dia. thru. C'Sink 100° x .78 dia. Tap ⅜-20 UNEF—2B thru.

Total Operations 96
Total Different Tools.....10

JOB FACTS

Machine.....Six Burgmaster 6-Spindle Radial Turret Drills
Part.....Hydraulic Manifold
Material.....Aluminum
Total Operations.....96
No. of Different Tools.....10
Lot Sizes.....1 - 20
Number of Types.....1
Accuracy.....±.002 to ±.005 and .004 True Position
Fixture.....Special Fixtures with Drill Bushings
Former Method.....4 and 6 Spindle Table Drills
Former Time.....1½ Hours
Present Time.....½ Hour

PRODUCTION INCREASED BY 3 TIMES

One of the SIX Burgmaster Radial Turret Drills used for Drilling, Countersinking, Tapping, Drill Heli-Coil Tapping, and Reaming Operations on Terrier Missile Hydraulic Manifolds at Convair (Pomona), a Division of General Dynamics Corporation.

The completed Terrier Missile Hydraulic Manifold showing some of the 96 operations which utilize ten different tools to produce.

Write for bulletin describing Burgmaster 6-Spindle Radial Drills in detail, also 20-minute 16MM sound film showing Burgmaster Turret Drills in operation, including the new Automatic Tape Controlled Machine, available from any office.

BURG TOOL
MANUFACTURING COMPANY, INC.

15001 South Figueroa Street, Gardena, California
FAculty 1-3510 DAvis 9-4158

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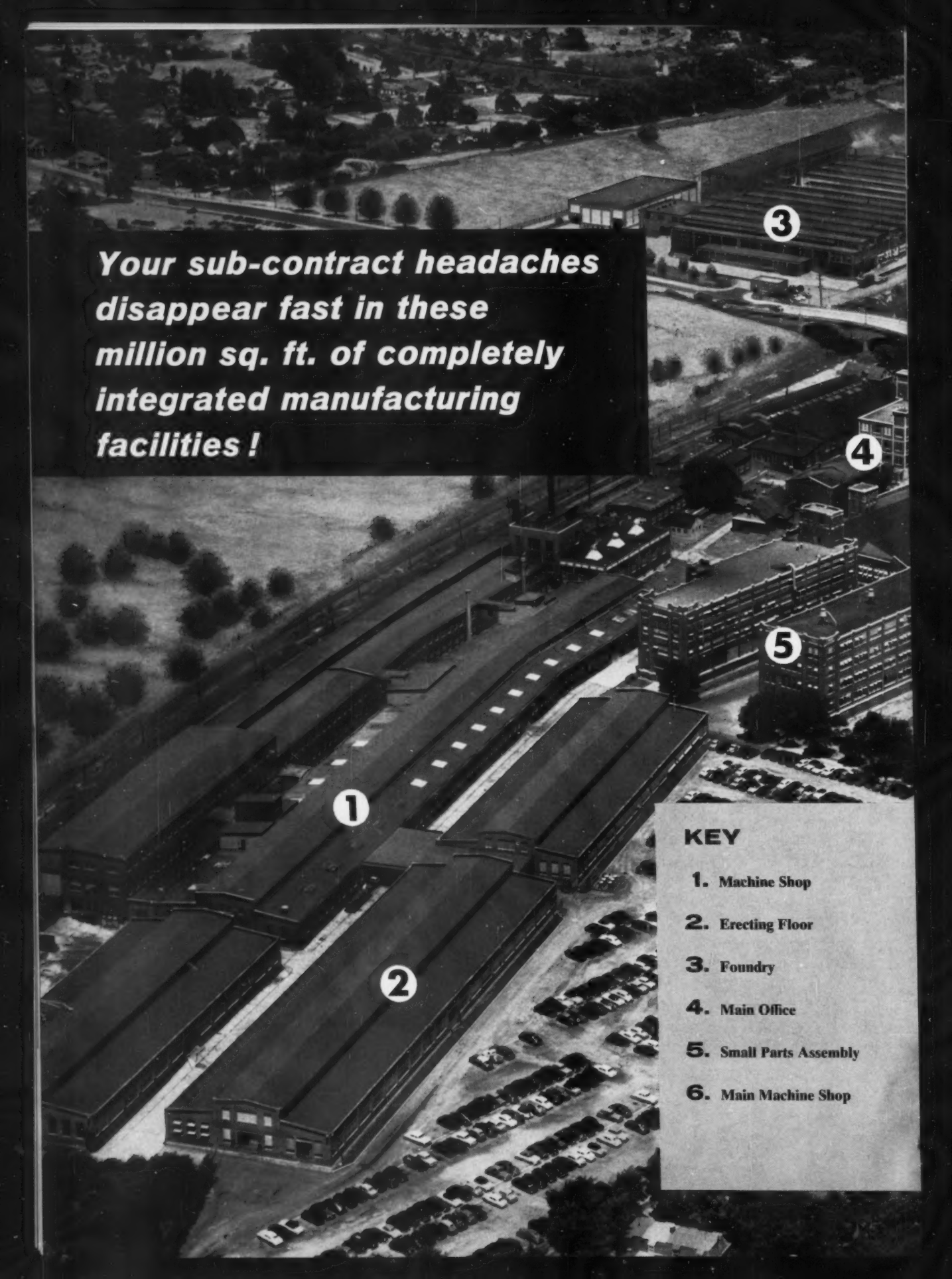
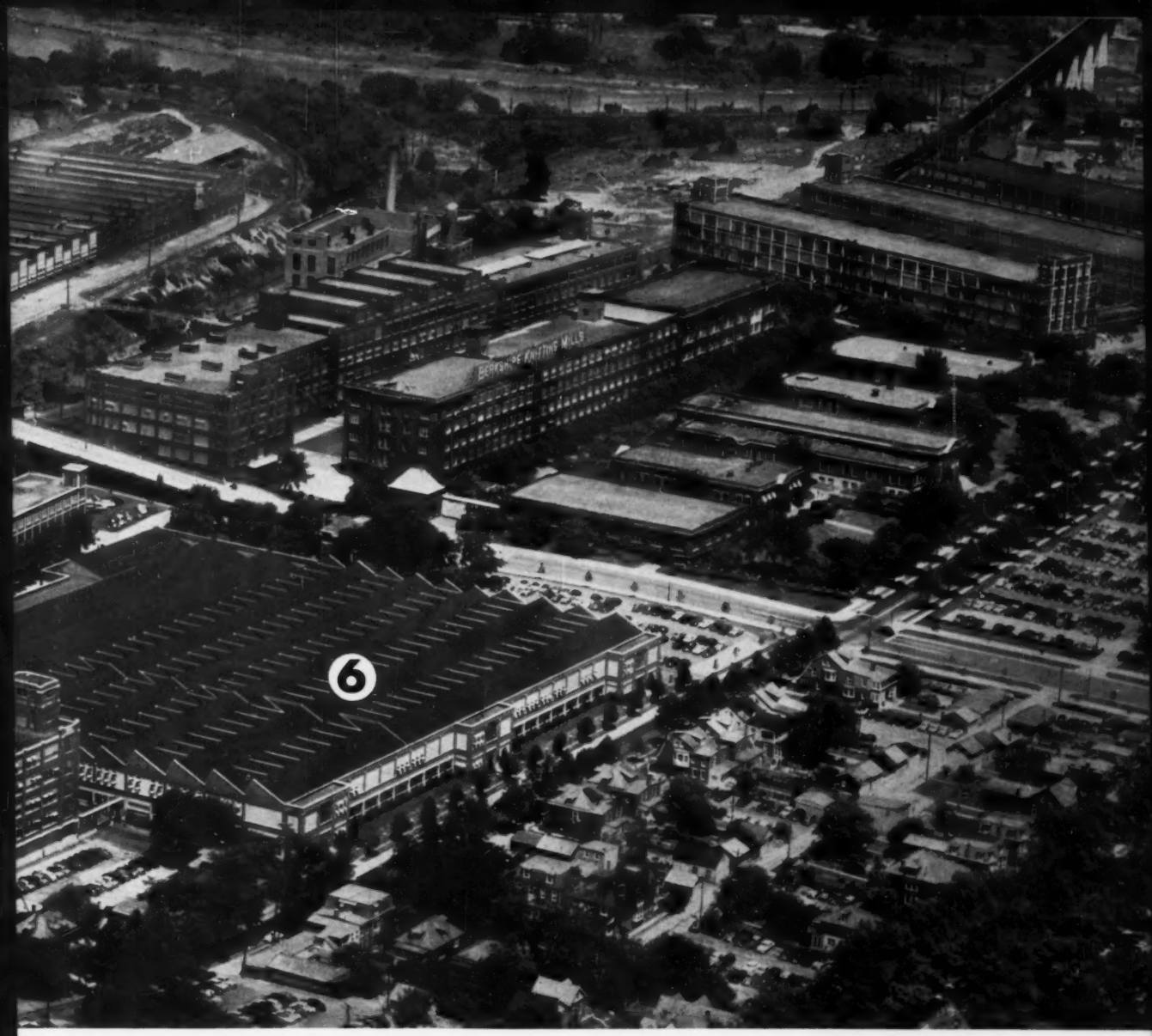
Plus dealer representatives in other industrial centers.


Your sub-contract headaches disappear fast in these million sq. ft. of completely integrated manufacturing facilities !
3
4
5
1
2
KEY
1. Machine Shop
2. Erecting Floor
3. Foundry
4. Main Office
5. Small Parts Assembly
6. Main Machine Shop



Nothing's quite so important in sub-contracting as *single* responsibility . . . one single responsible source that you can depend on for quality, accuracy, and on-time delivery of your components, assemblies and complete machines.

You get all this when you work with one of the world's largest, most modern and completely integrated manufacturers, whose 65 years' experience in precision (tolerance to 10ths) manufacturing is available to you *now,* on either a short or long-term basis.

Textile Machine facilities include 1200 *modern* machine tools of all types and sizes, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen, including a corps of the industry's top designers and engineers.

Combine these facilities with electronic punch card production scheduling controls and quality control techniques—and you've got the perfect answer to all your sub-contract problems . . . right *under one roof.*

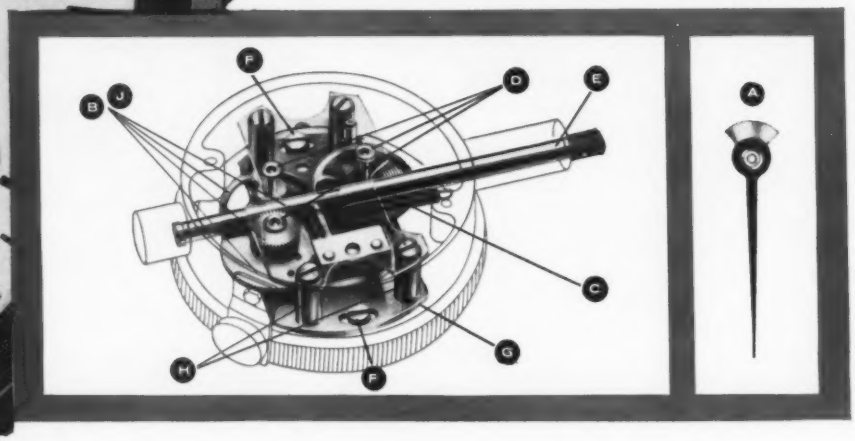
For more details, or for latest Facilities File Folder, call or write:

TEXTILE MACHINE WORKS

Contract Division • Reading, Pennsylvania

You get all these *Plus Features* only in Federal Indicators

Full Jeweled Bearings, Unit Movement, Low Inertia Indicating Hand, Tough-Hardened Gears — each of these advancements pioneered by Federal has a particular significance to you in terms of better performance. AND with all these *plus* features, Federal Dial Indicators generally sell for LESS due to their wide acceptance which has made possible the economies of quantity production. Here are the features and reasons why they are important:



A **Functionally designed Indicating Hand** balanced for low inertia, provides greater sensitivity and better repeat accuracy. Hand has highest strength-to-mass ratio to preserve position and shape under heavy gaging action.

B **Precision-made, Stainless Steel Gears, Rack and Pinion,** for a rustproof, smoother running, more accurate movement.

C **Positive Contact** with minimum pressure for faithful indicator response.

D **Full Jeweled Bearings** reduce friction, for improved accuracy over a longer period of time.

E **Precision Fit** of spindle and bearing for better repeat accuracy.

F **Accurate Movement Positioning** for optimum rack and gear alignment. Provides extremely close and positive control over a critical fit in *every* indicator.

G **Unit Construction** for easy maintenance and adjustment.

H **Rigid Assembly** of top and bottom plates for accurate gear alignment essential to minimum wear.

J **Tough-Hardened Gears** available optionally on most models for greatly increased life, reduced friction and improved sensitivity.

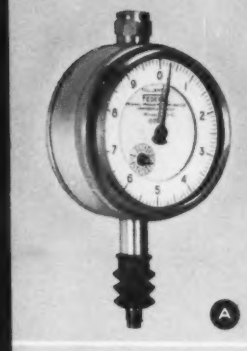
Ask for your copy of Catalog 58. It describes the full line of Federal Dial Indicators — the world's most extensive line.

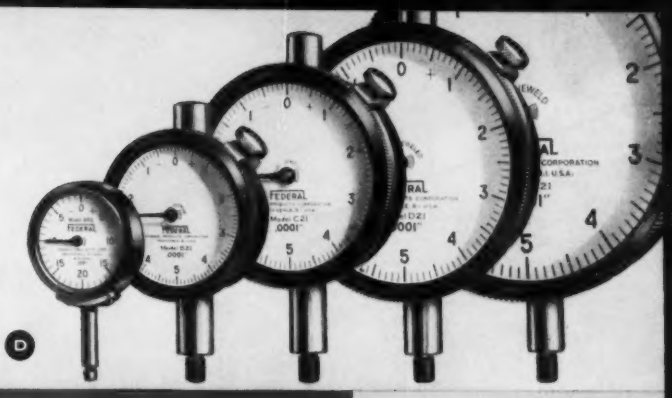
FEDERAL PRODUCTS CORPORATION • 9113 Eddy Street • Providence 1, R. I.

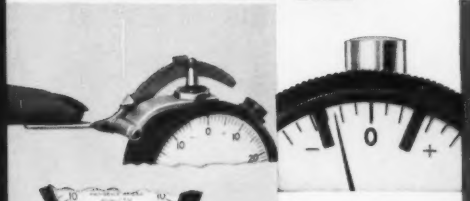
Ask **FEDERAL** *First*

for recommendations in modern gages . . .

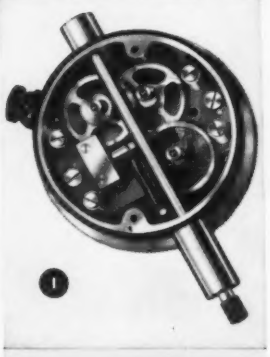
Dial Indicating • Air • Electric, or Electronic — for inspecting, measuring, sorting, or automation Gaging

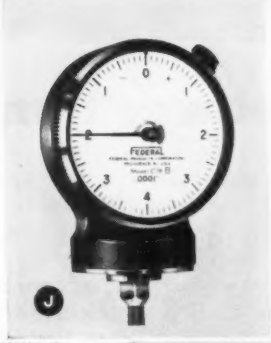






whatever you need in DIAL INDICATORS





A **Wet-proof Indicator.** Protected from coolant, oil, oil fog, and other liquid contaminants. Seven models, four magnifications.

B **Series L Testmaster.** Long range (.032" and .060"), high magnification. Large or regular size dials, two styles. .0001" or .0005" grads., eight models.

C **Series M Testmaster.** The Universal Test Indicator. Two styles. .001" or .0001" grads., eight models, plus non-magnetic.

D **Regular Dial Indicators.** Five sizes including A.G.D. groups 1 through 4. Over eighty different basic models plus thousands of variations.

E **Auxiliary Plunger** (new precision transfer unit) and new **Cam Type Lifting Lever** extend usefulness and preserve accurate reading of Federal Dial Indicators.

F **New style Tolerance Hands** set easily, lock securely. **Weights** for measurement of compressible materials. Made to your or A. S. T. M. specs.

G **Perpendicular Indicators.** Two sizes, seven models. Crown or spiral gear movement.

H **Long Range Indicators.** Wide variety of models up to 3" range, .001" to .0001" grads.

I **Hardened Gear Movement** greatly increases indicator life, improves performance. Available on all A.G.D. models . . . most other models.

J **Super-Sensitive Indicators.** Ultimate in indicator precision. Five models, .0001" or .00005" grads.

K **Dials** for any magnification. Also balanced, continuous, clockwise, counter-clockwise — with rev. counters, special markings, etc.

L **Attachments.** Right Angle or Hole . . . precision transfer units for checking "inaccessible" places.

M **Contact Points.** Many shapes, dozens of sizes. Polished tips, hardened steel, chrome, T.C., etc.

N **Backs.** Regular, offset, post, screw, adjustable, and flat. Special backs to order.

Ask for Catalog 58 describing the complete line of Federal Dial Indicators.

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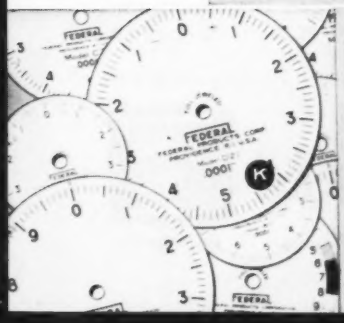
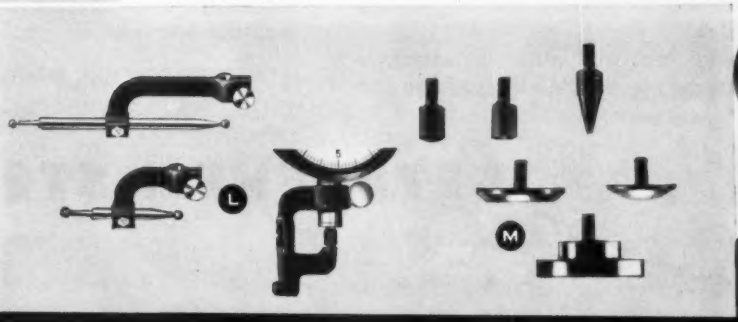
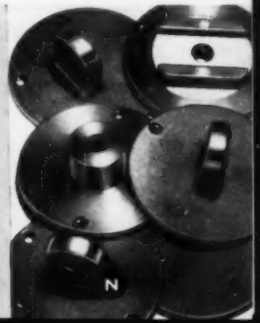
Dial Indicating • Air • Electric, or Electronic — for inspecting, measuring, sorting, or automation Gaging







Huge shaft to help make power hum

This forged generator shaft is a giant that will do a giant's work. At one of the great Northwestern dams it will take its place in the hydroelectric plant.

The big forging weighs 95 tons, is more than 33 ft long, and has a 15½-in. bore throughout its entire length. Made of carbon-vanadium steel, it was carefully heat-treated to produce the desired mechanical properties.

Huge shafts like this, and other high-tonnage items, are no strangers to the Bethlehem forge and machine shops. Yet Bethlehem forged products are not always king-size. We are equipped to handle all weights and shapes, from the real giants of the family to midget drop forgings.

Call us whenever we can be of service. No matter how complex your designs, Bethlehem technicians will meet all specifications. When Bethlehem does the job, you can be doubly sure of its quality.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
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BETHLEHEM STEEL

BETHLEHEM STEEL

LOOK!

LOGAN HAS IT!

RIGHT PRICE

TOP QUALITY

PEAK PERFORMANCE

the most complete line of

POWER CHUCKING EQUIPMENT

LOGANSPORT MACHINE CO., INC.
810 CENTER AVENUE, LOGANSPORT, INDIANA

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- ☐ 100-2 MILL-TYPE AIR CYLS.
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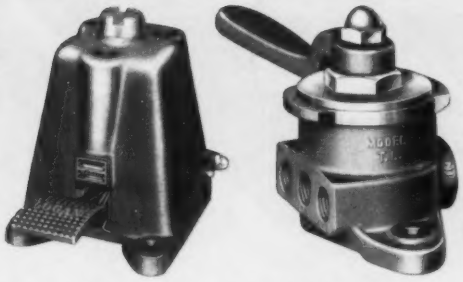
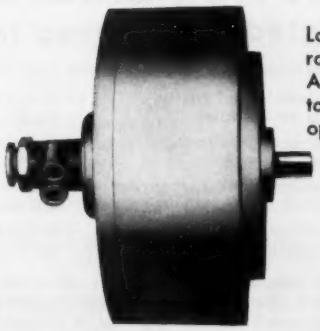


Logan Control Valves—Complete line of actuators available—for manual, semi-automatic or automatic control.

Model 400 RFL Unit Reducing Valve, pressure gauge and lubricator in compact aluminum housing.

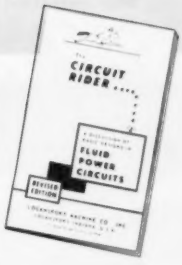
Logan Standard Chucks from 6" to 24" diameter; specials to meet your needs.



Logan Double Acting, rotating type cylinders. Air operated sizes 1½" to 20" bore. Hydraulic operated 3" to 14" bore. Hollow or closed center.

FREE **SEND FOR YOUR COPY OF LOGAN "CIRCUIT RIDER"**

A 32-page manual on fluid power circuits (fifth edition) completely revised to present current engineering trends.



MEMBER: Natl. Mach. Tool Builders' Assn. Natl. Fluid Power Assn.

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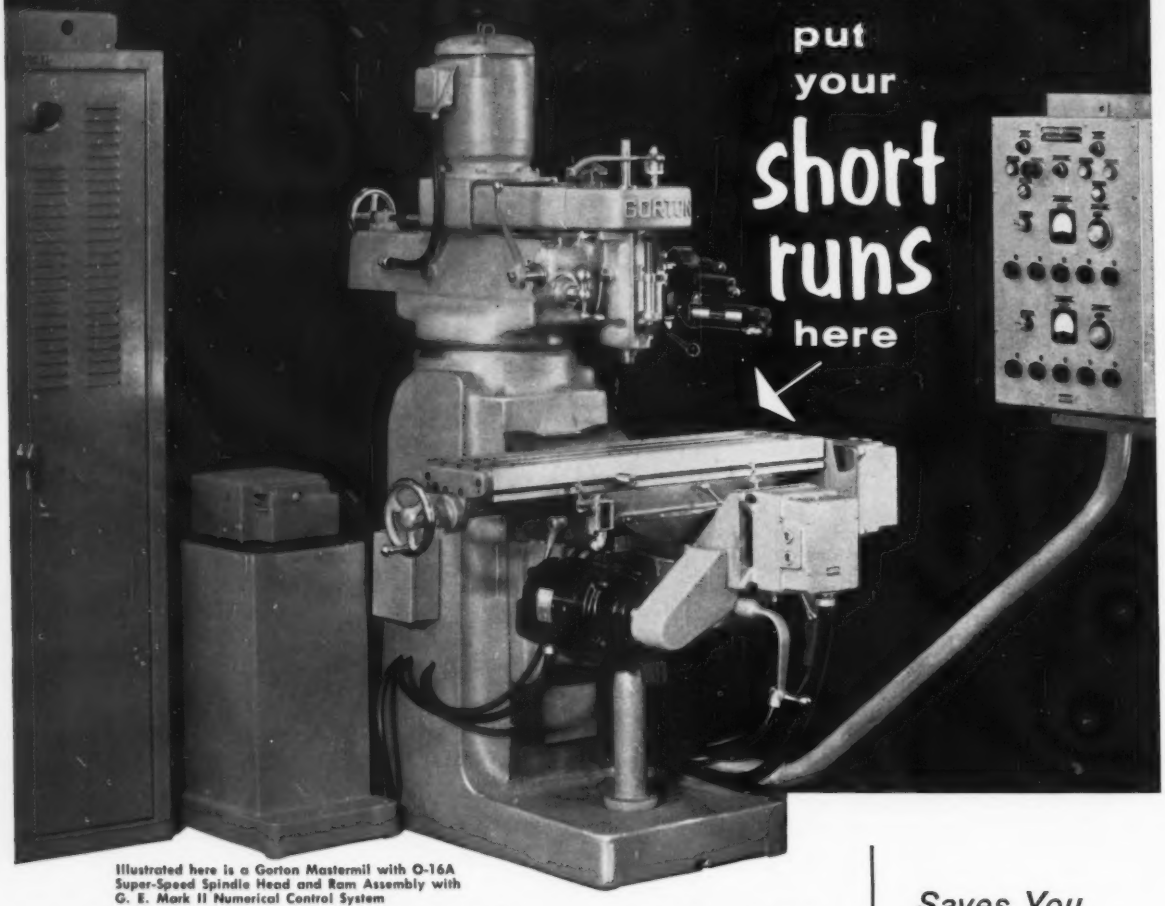

Illustrated here is a Gorton Mastermil with O-16A Super-Speed Spindle Head and Ram Assembly with G. E. Mark II Numerical Control System

GORTON NUMERICAL CONTROL

is field tested and proved in use

This is how Gorton Numerical Control saves you money on short runs:

- — eliminates elaborate and costly tools, dies, jigs and fixtures
- — wastes no time because operator does not "pace" the work
- — makes no mistakes because operator skill not required
- — extreme, repetitive accuracy is easy and automatic
- — change overs in set-ups can be made quickly
- — signals operator when tool changes are needed
- — guides cutter in close quarters without damage to work or cutter
- — making punched tape is simple typewriter operation

Punched tape . . . or magnetic tape control . . . is available to you on SIX standard Gorton machines and also on Gorton custom-designed machines. You'll be agreeably surprised when you learn the low cost of Gorton Numerical Control and how much more it gives you for your money. For full information write

Saves You Money on —

- face milling
- side milling
- end milling
- straight line cavity milling
- slotting
- drilling
- reaming and boring

Your letterhead inquiry will receive prompt attention.

GORTON

GEORGE *GORTON* MACHINE CO.

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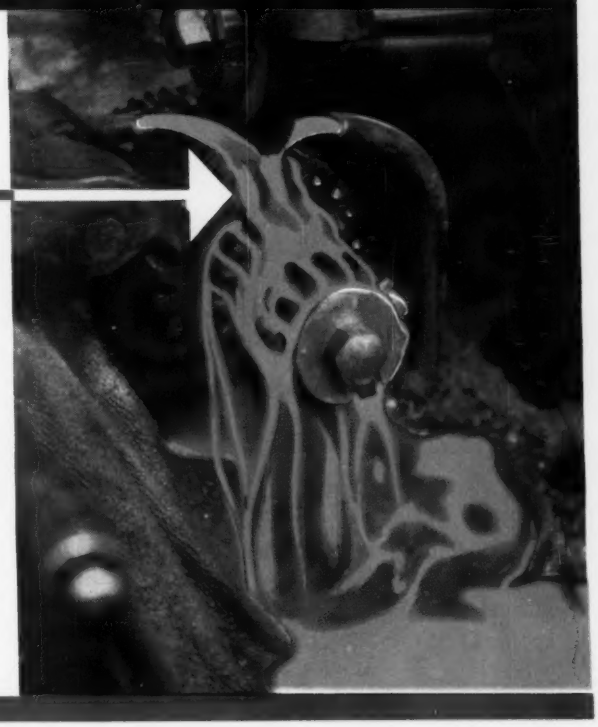
Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

a "NEW LEAF" in coolants... New 100% Chemi-Cool HOCUT cools... lubricates... prevents rust... stays mint-fresh for life!

At the point of proof

NEW HOCUT 237

rests its case!



Industry's newest synthetic cutting fluid—new HOCUT 237—was just introduced within the past year. Yet, in these few months it has proved itself one of the most versatile, effective and economical coolants ever to appear on the metal-working scene.

Already our files are filling with proven case histories* of new savings and new efficiencies our customers are getting with new HOCUT 237. Here are some of the reasons why this unique new all-chemical coolant has earned such quick acceptance:

*yours on request

- **Permanently odor-free**
  Needs no "additive" to stay clear and fresh-smelling for life. Cannot turn rancid or harm hands. Keeps your shop clean and your operators happy.
- **Cools work and tools quickly**
  Faster cooling speeds machining time—prevents welding and chip build-up, and increases tool life.
- **A lubricant that works**
  The secret is in a new synthetic high-molecular-weight lubricity additive—which, in plain language, means all the lubrication advantages of a "soluble oil"—with none of the disadvantages.
- **Protects tools and work from rust**
  Work coming off the machine is coated with a two-stage rust preventive. Tools, ways, slides and bearings get real protection.
- **Best for economy**
  Initial cost is only a few pennies per gallon in the machine. Expense of clogged filters is eliminated and filtration speeded up. HOCUT can be used and re-used for months. Disposal is never a problem.

You can get all these benefits of new HOCUT 237 in your own plant by calling your Houghton representative today. Or write: E. F. Houghton & Co., 303 W. Lehigh Avenue, Philadelphia 33, Pa.

HOCUT 237... *a product of*

E. F. HOUGHTON & CO.

PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

Ready to give you on-the-job service

For more data, circle this page number on inquiry card

SKF RACES *Against Time...*

with the

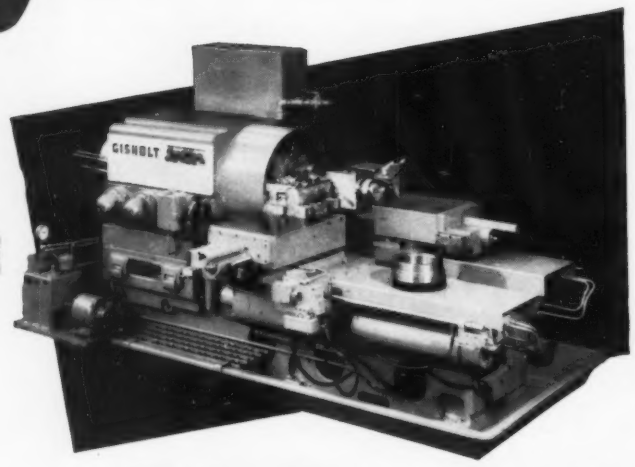
GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

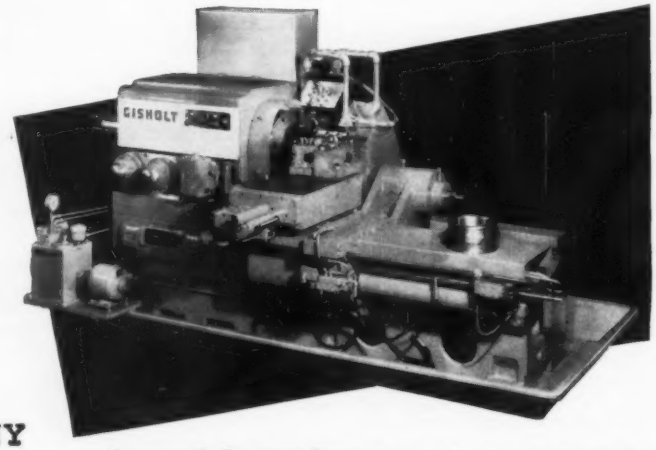
These big Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24″ diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.



First Operation: Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.

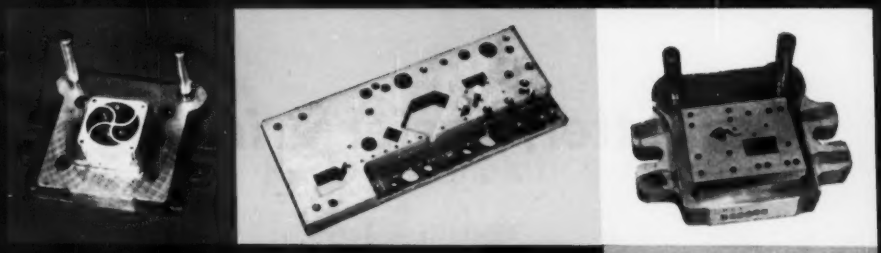


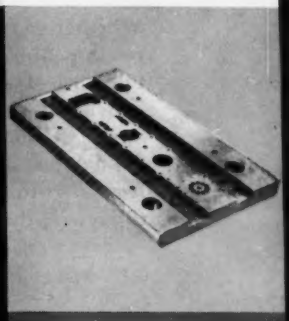
Second Operation: Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003″ to .0045.″

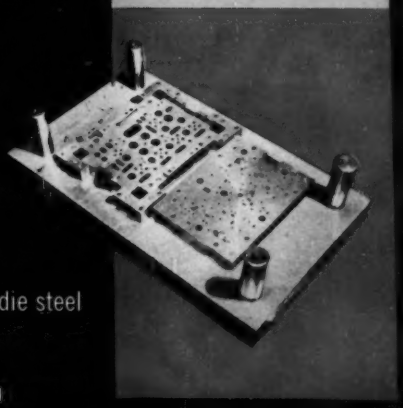
GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

MASTERLINE GISHOLT SINCE 1887 GISHOLT

ASK YOUR GISHOLT REPRESENTATIVE ABOUT GISHOLT FACTORY-REBUILT MACHINES WITH NEW MACHINE GUARANTEE







vega

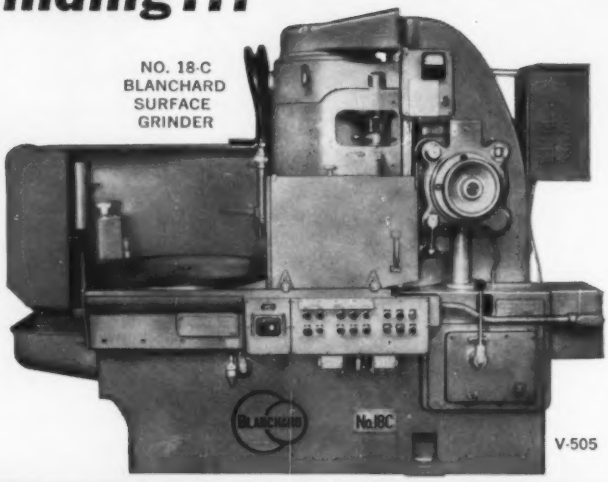
air-hardening tool and die steel

is widely recognized as a leader in freedom from size change and distortion. No other steel has such a job-proved record of succeeding where other grades have failed. VEGA was specially developed by Carpenter to combine toughness and the machining properties of an oil-hardening steel with the safety in hardening of an air-hardening grade. We'll gladly prove the facts. Call your local Carpenter SERVICE-CENTER. Complete stocks assure you immediate delivery

the *Carpenter* Steel Company, Reading, Pa.

For better, easier grinding...

Whether you're "hogging" off stock from rough castings or precision grinding to a tolerance of ±.0005", you can do it better and easier with the Blanchard No. 18-C Surface Grinder. Once the work is set up, the automatic cycle handles every operation from start to finish. The operator is free to prepare the next load of work or to operate a second No. 18-C Grinder.



Cast Iron Plate. Blanchard ground at the rate of 30 pieces – 60 surfaces – per hour. Stock removal ⅛" each side.

Steel Bars. Blanchard ground at the rate of 48 pieces – 192 surfaces – per hour. Stock .040"-.045" from each side. Limits ±.001" square, flat and parallel.

Hot Rolled Steel Cams. One operator and one No. 18-C Blanchard produce 225 pieces – 450 surfaces – per hour. Stock removal 1/32" each side. Limits ±.001".

just push a button...

- Automatic size control to ±.0005"
- Duplication of repetitive loads
- Pre-set "spark out" time for flatness and surface finish
- No more "operator worry" on close work – greatly reduced fatigue
- A large part of operator's time available for
  - (a) Handling or slushing work pieces
  - (b) Filing burrs
  - (c) Selecting correct wheel and preparing for next job
- Specially-designed sizing device with built-in feature to compensate – automatically – for wheel wear during grinding cycle.

All of these features give you *more efficiency at reduced costs!*

PUT IT ON THE BLANCHARD

Send for your free copy of Model 18-C folder.

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

how THOMPSON RAMO WOOLDRIDGE *reduces their cost savings opportunities to careful analysis*

ENGINEERING ECONOMY STUDY

STUDY NO. 55-076

DIVISION [redacted]	WORKS: Tapco	CAPITAL EXP. PROJECT: 11-55-007
PROJECT DESCRIPTION [redacted]	Automatic Chucker	
DEPARTMENT: 1120 Pumps	PRODUCT: Oil Burner Pump Body FR-2154	EST. LIFE OF JOB: 15 YEARS

1-PRESENT FACILITY		2-PROPOSED FACILITY	
a. DESCRIPTION [redacted]	Turret Lathes (2)	b. DESCRIPTION [redacted]	Automatic Chucking Machine
MOD. SIZE [redacted]	T.P. NO. 1524, 1525; DATE MFG. 1942	MOD. SIZE [redacted]	PRIN. SERV. LIFE: 11 YEARS
b. NET VALUE	$ 4,250 / $ 3,960	b. INSTALLED COST	$ 25,000 / $ 25,800
c. USAGE: 13-1/2 HRS. DAY	d. CAPITAL ADDITION $ 2,000 FOR 4 YEARS	c. USAGE: 4-1/2 HRS. DAY	4 HRS. DAY
e. INTEREST 10% X NET VALUE	$ 425 / $ 396	g. NET SALVAGE VALUE	$ 1,500
f. NEXT YEAR SALV. LOSS	$ 500 / $ 500	h. PERCENT SALVAGE ($\frac{g}{c}$)	6 % / %
g. 10% INT. CAP. ADD.	$ 200 / $ 200	i. CHART PERCENT	23 % / %
h. CAP. ADD PRORATED	$ 500 / $ 500		
(a) NEXT YEAR'S CAPITAL COST (e + f + g + h)	$ 1,625 / $ 1,596	(b) NEXT YEAR'S COMPOSITE COST (h x i)	$ 5,750 / $ 5,934

3-OPERATIONAL COMPARISON

	PRESENT		PROPOSED	
OPERATING COSTS				
DIRECT LABOR	$ 16,500	$ 14,850	2,710	$ 2,295
INDIRECT LABOR				
SET-UP			325	293
MATERIAL				
MAINTENANCE	500	500	50	50
TOOLS/EXP. ITEMS	7,200	6,480	4,800	5,100
POWER CONSUMPTION	852	767	250	212
FLOOR SPACE				
PROPERTY TAX	64	64	397	410
REWORK SCRAP	960	864	720	648
DOWNTIME				
DELETE ADD OPER				
FRINGE BENEFITS	3,150	3,159	658	565
SUB CONTRACT COSTS				
OTHERS				
INCOME LOSS	*	1,500		
TOTALS	$ 29,586	$ 28,184	$ 9,910	$ 9,573

(C) EXCESS OPERATING COST OF PRESENT FACILITY (PRESENT MINUS PROPOSED): $ 19,676 / $ 18,611

4-GAIN FROM CAPITAL EXPENDITURE			5-COMPARISON FACTOR
a. NEXT YEAR GAIN (A PLUS C MINUS B)	$ 15,551	$ 14,273	.75 / .65
b. NET INVESTMENT (2b MINUS 1b)	$ 20,750	$ 21,840	

PREPARED BY: John J. Smith	DATE: 8/24/55	DATE: 7/7/56
DIV. IND. ENG.: Robert Jones	DATE: 8/27/55	DATE: 7/15/56

"We at Thompson Ramo Wooldridge consider the proper administration of a capital expenditure program one of the prime responsibilities of management."

J. D. Wright
Chairman of the Board
THOMPSON RAMO WOOLDRIDGE INC.

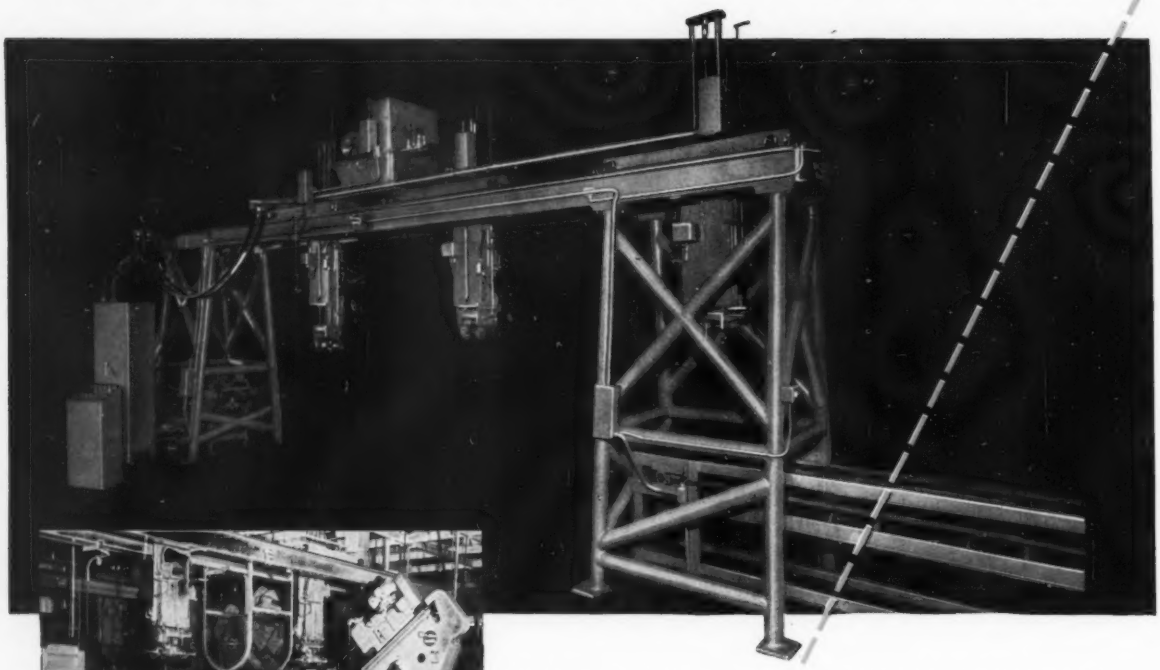
***Gain from replacement by the TRW formula . . . after required interest or return on the new investment . . . after full allowance (by the formula) for future obsolescence of the new equipment.**

Rockford Insert Group

March, 1959

Keep gathering metal-working production ideas . . . be well informed when you replace machinery . . .

production efficiency *increased*



ANOTHER EXAMPLE OF PROCESS EQUIPMENT DESIGNED AND BUILT BY W. F. & JOHN BARNES

The automatic work handling equipment shown above is one of three machines designed and built by Barnes for an automobile manufacturer. This equipment automatically transfers crankshafts between the rough Balancing and Barnes Drilling Machines. By eliminating manual loading and unloading, a substantial increase in production efficiency over previous methods is effected. With this specially designed and engineered equipment, one operator now handles the entire balancing and drilling operations. All units are electrically interlocked and timed in sequence with overall production requirements.

You will find the varied engineering and creative skills at Barnes that are necessary to design and build this type of process equipment. These skills are the result of over 80 years of machine building experience. All planning, engineering, and manufacturing efforts are closely coordinated in one plant. You get a complete, dependable service from one source with no divided responsibility.

View of Special Barnes Handling Unit, Crankshaft Balancing and Barnes Drilling Machines in automobile plant. After crankshafts are conveyed to load station and manually positioned for pick-up, operating sequence is as follows: (1) Three overhead pick-up units descend, grasp workpieces, and automatically rise simultaneously to traverse position. Left-hand unit picks up unbalanced crankshaft at loading station. Center unit removes piece from Balancer and right-hand unit removes part from Drilling Machine; (2) all units traverse one station to the right and descend. This positions a new workpiece in the Balancing Machine, transfers workpiece in the Drilling Machine, and a finished part on a discharge conveyor; (3) all units automatically rise and return to initial starting position. Complete Barnes equipment also includes electrical controls, and special in-feed and discharge conveyors.

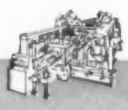
ASK FOR AN ANALYSIS OF YOUR WORK HANDLING METHODS

Find out how this specialized engineering and building service can help you cut costs. Write today for an analysis of your production methods or ask for new 16-page catalog entitled "Automatic Process and Transfer Equipment."

W. F. & JOHN BARNES CO.
402 South Water Street, Rockford, Illinois

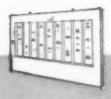
W. F. & JOHN BARNES

Multiple Spindle Machine Tools



Special Transfer Equipment

Special Electrical Controls



BUILDERS OF BETTER MACHINES AND EQUIPMENT SINCE 1872

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

Ideas and machine features that reduce hidden costs on lathes

If you're looking for practical ways to reduce hidden costs, you'll want this new booklet — 16 pages of illustrated text on Barber-Colman's all-new 36-speed lathe. See how power, rigidity, speed, and versatility are combined in a precision machine that has all the features needed for efficient toolroom or production turning.

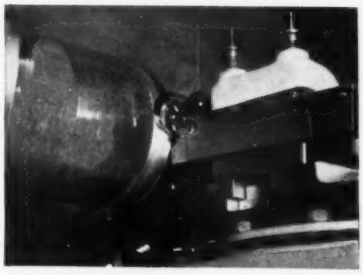
How a modern, high-speed lathe can pay for itself quickly with throwaway insert tooling. →

Shows you how Barber-Colman combines more speed and versatility in a high-precision machine

Now . . . tool sharpening and downtime for tool changing are unnecessary costs on lathes. Throwaway inserts solve these problems and make a modern, high-powered lathe one of the most profitable investments you can make.

This new booklet shows how the combination of carbide tooling and high machine speeds can add new dollars to today's low profits . . . particularly on long turning operations or high-production jobs. In it you will see how Barber-Colman's heavy, reinforced headstock, with precision spindle supported at both ends and in the middle by three sets of precision-tapered roller bearings, provides new rigidity through all speeds up to 2000 rpm — speeds you can use on steel or for fine-finish turning of nonferrous materials. You'll like the deep, heavy-duty apron, the extra-large bearing surfaces and wide 30" span (over ways) of the carriage.

The opposite end has a "new look," too — 400 lb tailstock with a large 4½" diameter spindle is positioned easily and quickly with one hand because it's antifriction mounted.



Heavy-duty tool post is designed for high-speed turning with throwaway insert tools.

These are some of the features illustrated that make the Barber-Colman 36-speed lathe such an attractive investment for every shop.

Speeds short-run turning and threading

Suppose your work consists primarily of one-piece jobs requiring a series of facing, turning, boring, reaming, and threading operations. You'll want to save time *between cuts*, as well as in the cut. This advertisement can't list all of Barber-Colman's timesaving controls, but the new bulletin can. For example, you'll see how quickly and easily you can shift gears simply by turning two dials on the headstock. All the threading features you need are designed and constructed for maximum precision and ease of operation. Unique supports for the lead screw and feed rod on long bed machines are automatically picked up and released by the carriage. They give added support to the lead screw to assure accurate threads of any length. These and many other design advantages are fully described and illustrated.

Write us or phone your Barber-Colman representative to get this important new lathe information coming your way.

Barber-Colman Company
32 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools.

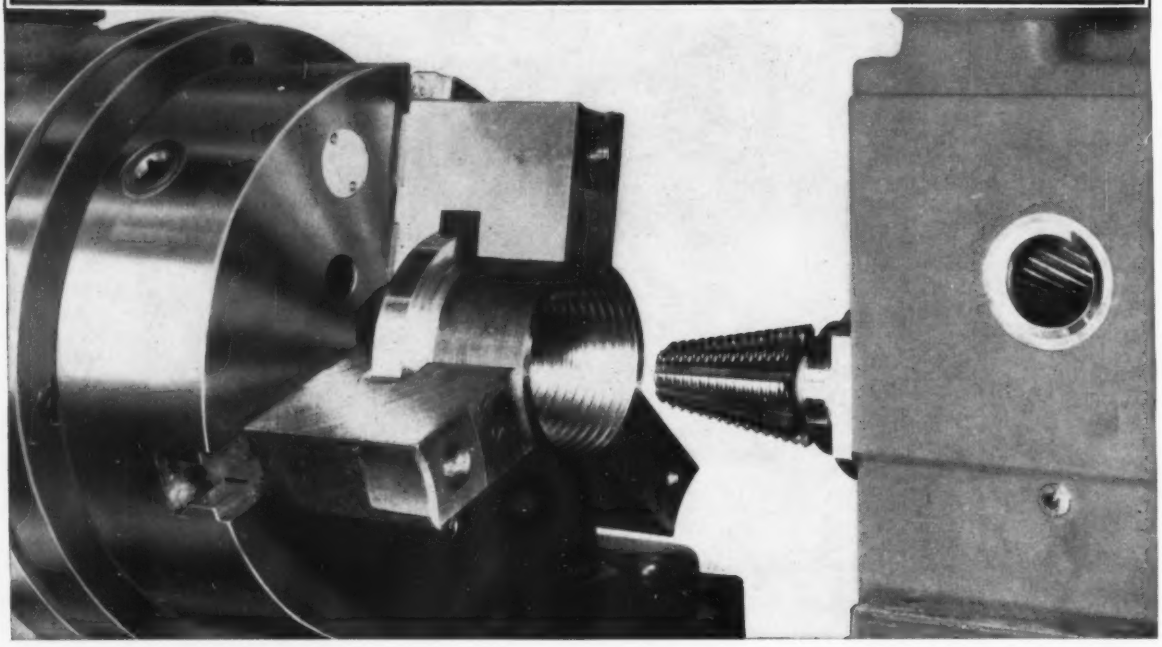
BARBER COLMAN ®

PRECISION LATHES

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

SUNDSTRAND

"ENGINEERED PRODUCTION" NEWS



Thread Milling Added to Sundstrand Service

Further expansion of the Sundstrand Machine Tool Company's service is announced with the addition of Hanson-Whitney thread milling machines. Four standard sizes of machines are included in the line with specially fixtured or adapted machines available for unusual threading requirements.

The Hanson-Whitney method of thread milling uses multiple-thread milling cutters and can be used to generate internal or external, right or left hand, straight or taper, standard or special threads on a wide variety of parts. Precision cams control the whole process automatically, the operator only has to load and unload. Workpieces can be held on centers, in standard chucks, or in special fixtures. Simplicity of setups permits them to be handled in minimum time.

Application of Sundstrand "Engineered Production" to this thoroughly proved line of thread milling machines opens new opportunities for production improvements and cost reductions. Sundstrand's experience in every type of manufacturing job, coupled with unmatched skills in machine and fixture design, has solved thousands of milling, turning, broaching, grinding, and special machine problems. These same skills and experience now being applied to thread milling are sure to provide similar user benefits wherever the process is applied.

Advantages of H-W Thread Milling

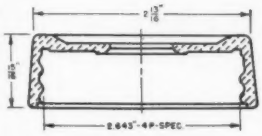
- Produces thread pitches too coarse for practical die cutting.
- Speed and efficiency improved over single point cutting in a lathe, disc-type cutters in a conventional thread miller, or single wheel grinding.
- Threads produced are smoother and more accurate than those obtained with tap or die.
- Pitch diameter of threads bears definite and accurate relationship to other workpiece elements.
- Permits automatic convolution of the first thread.
- Threads can be produced in locations impossible or impractical through use of lathe, tap or dies.
- Close tolerances are readily maintained on repetitive parts.
- Scrap losses are held to a minimum even on high speed, close tolerance work.
- Semi-automatic operation permits one operator to handle several machines.

AUTOMATIC LATHES | RIGIDMILS | SPECIAL MACHINES | DRILLING MACHINES | GRINDERS

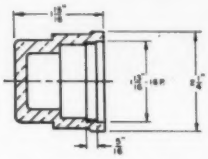
SUNDSTRAND

MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

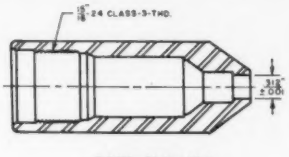
Typical parts thread milled on H-W machines



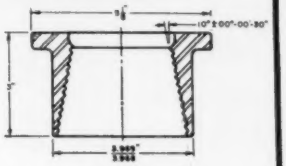
PART—Container End
MATERIAL—Die Cast
THREAD—4-Pitch Special Form
MACHINE TIME—17 seconds



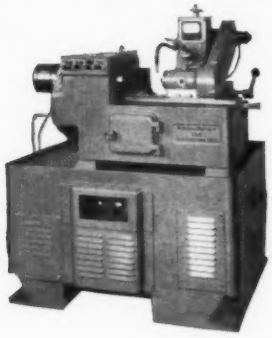
PART—Fuse Part
MATERIAL—Aluminum
THREAD—1-13/16-16, N. S. 3 THD.
MACHINE TIME—15 seconds



PART—Valve Nut
MATERIAL—1141 Steel
(Rockwell "C" 26-32)
THREAD—15/16—24, N. S. 3 THD.
MACHINE TIME—28 seconds

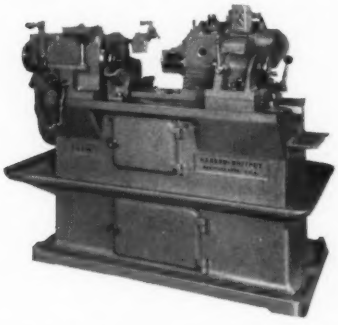


PART—Ferrule
MATERIAL—4340 steel
(Rockwell "C" 28-32)
THREAD—5 Pitch Special Taper



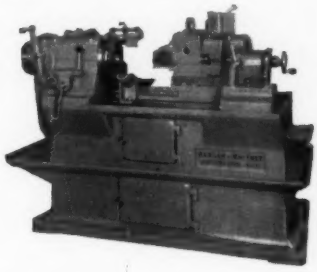
4 x 9 inch semi-automatic (hydraulic)

Smallest size of machine in the Hanson-Whitney line has an external capacity of 4″ diameter with a 2″ cutter and an internal capacity of either 4″ diameter with a 2″ cutter, or a 3/4″ minimum diameter with 1/2″ cutter. Collet to tailstock center distance is 12″ and thread can be cut up to 9″ from collet. Maximum lead for either hand of internal or external thread is 1/5″. Machine occupies a floor space of 43″ x 68″.



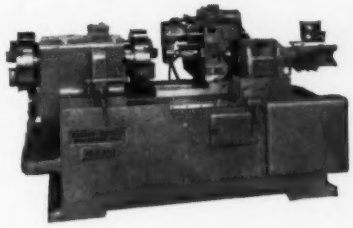
8 x 16 inch semi-automatic

Distance from collet to tailstock center is 27″. Thread can be cut for a distance of 16″ from collet. External thread capacity is up to 8″ diameter with a 2-1/2″ cutter, internal thread maximum capacity is 8″ with a 2-1/2″ cutter and 1″ minimum diameter with a 7/16″ cutter. Machine is supplied with drawback collet mechanism, with master collet 2″ or 3″, cutter head with arbor and arbor support for cutters 3-1/2″ long, one lead cam for any pitch specified, coolant equipment and complete electrical equipment as standard equipment.



10 x 24 inch semi-automatic

External thread capacity is up to 10″ diameter with 2-1/2″ cutter and internal thread capacity ranges from 10″ diameter maximum with a 2-1/2″ cutter to 1″ diameter minimum, with a 7/16″ cutter. Standard machine equipment includes drawback collet mechanism with master collet 2-1/2″ or 4″, cutter head with arbor and arbor support for cutters 3-1/2″ long, one lead cam for any pitch specified, complete coolant system, and complete electrical system. Oversize workheads are available permitting up to 22″ swing over carriage and use of a 5″ master collet.



15 x 30 inch semi-automatic

External and internal capacity of the largest standard Hanson-Whitney machine is up to 15″ diameter with thread cut to 30″ from the collet. Swing over the carriage is 21″. Maximum lead for either right or left hand thread is 5/8″. Standard machine includes cutter head with arbor support, one lead cam for any pitch specified, coolant equipment, and complete electrical equipment. Like all standard machines in the line, it can be furnished with special cams to extend the range of cam throws.

To keep costs low while meeting special job requirements semi-standard machines can be developed which make maximum use of standard components, such as special cutter heads and supports, long beds, special work holding devices, and automatic loaders.

Get more thread milling data from Sundstrand. Write for Bulletin 601 today.

BROACHING TOOLS BROACHING MACHINES PRESSES

SUNDSTRAND
MACHINE TOOL CO.
2530 Eleventh St. • Rockford, Ill., U.S.A.

CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

MATTISON
HIGH-POWERED PRECISION
GRINDING METHODS

Chipless machining brings 3-way cost reduction at Ingersoll

Electrolytic grinding slashes cost of finishing brazed carbide tools

If you have tough, hard, or heat-sensitive materials to machine, look at how The Ingersoll Milling Machine Company, Rockford, Illinois, reduced machining costs 18% . . . slashed abrasive costs 80% . . . and made a reduction in scrap losses with a highly controlled application of electrolytic grinding.

The headache at Ingersoll's Cutter Division was in grinding the faces of brazed carbide-tipped milling cutter blades. On a horizontal spindle grinder, unit pressures were so high in order to penetrate the carbide, the wheel had a tendency to gouge into the soft shank steel. It was difficult to stop wheel-loading, heat-checking, and cracking—not good because almost 80% of the blade cost was lost in scrap occurring at this stage.

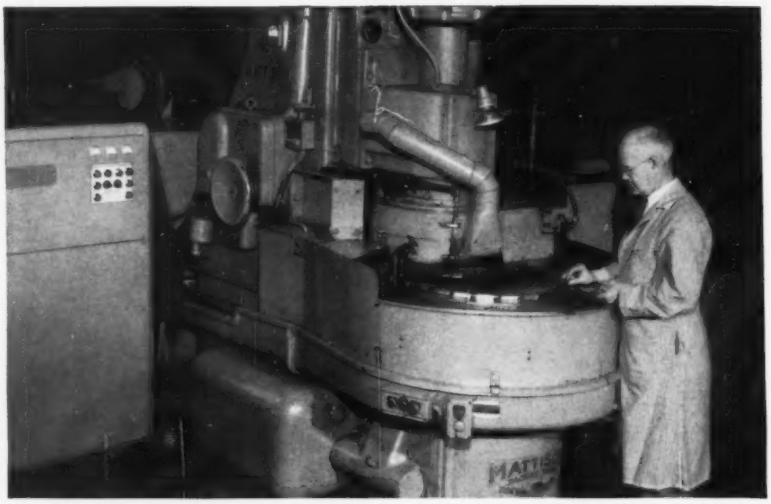


Fig. 1—**Single-pass electrolytic grinding,** with carbide removal averaging .005 to .008 in., is a more efficient method of finishing the faces of carbide-tipped milling cutter blades. Downtime for cleaning and loading the table is eliminated.

First continuous electrolytic process

The profit-significant features of this machine are:

1) continuous, single-pass machining.
2) high stock removal.

This is really the first application of electrolytic grinding to a machine that does not require batch-type loading and multiple-pass stock removal.

With the magnetic chuck slowed down to 12 revolutions per hour, the operator just loads the blades at one side of the table and picks off the finished blades from the other. Pie-shaped magnetic sections are energized automatically as the work passes under the wheel and are de-energized as it emerges on the other side. No machine adjustments are required until a new lot of different sized blades is to be ground—all nonproductive time for cleaning and loading the table has been eliminated.

Blades come directly from tip-brazing to the Mattison. With carbide removal averaging .005" to .008" per pass, the 1500-ampere electrolytic grinder finishes them to size in one pass, holding finish within 20 microinches, rms.

Since metal removal is now virtually a "scrubbing process," there's no danger of heat-checking or cracking. At the present rate of wear, using a 100-grit, 100-concentration diamond wheel with 1/16" depth of diamond, wheel cost per blade is 80% lower than it was on the horizontal.

If your problem is heat damage, high wheel costs, distortion of thin sections, difficult machining of carbides, or finding a suitable process for cutting tough super alloys, let Mattison evaluate the new economics of "chipless machining." It may be the solution you're looking for.

Fig. 2—**Finished blades** (left) have a surface finish of less than 20 microinches, rms. Tests at Ingersoll prove there's no difference in break strength or blade life when the electrolytic process is used.

Free Methods Study

You can inspect, first hand, the value of Mattison's new Quick-Tilt surface grinder for machining your own workpieces. Production tests show that the average grinding operation can be at least 50% more efficient with this new method. We will machine your parts in our Methods Laboratory and give you a complete job analysis which takes the guess out of grinding. There's no obligation—your Mattison dealer will make all the arrangements.

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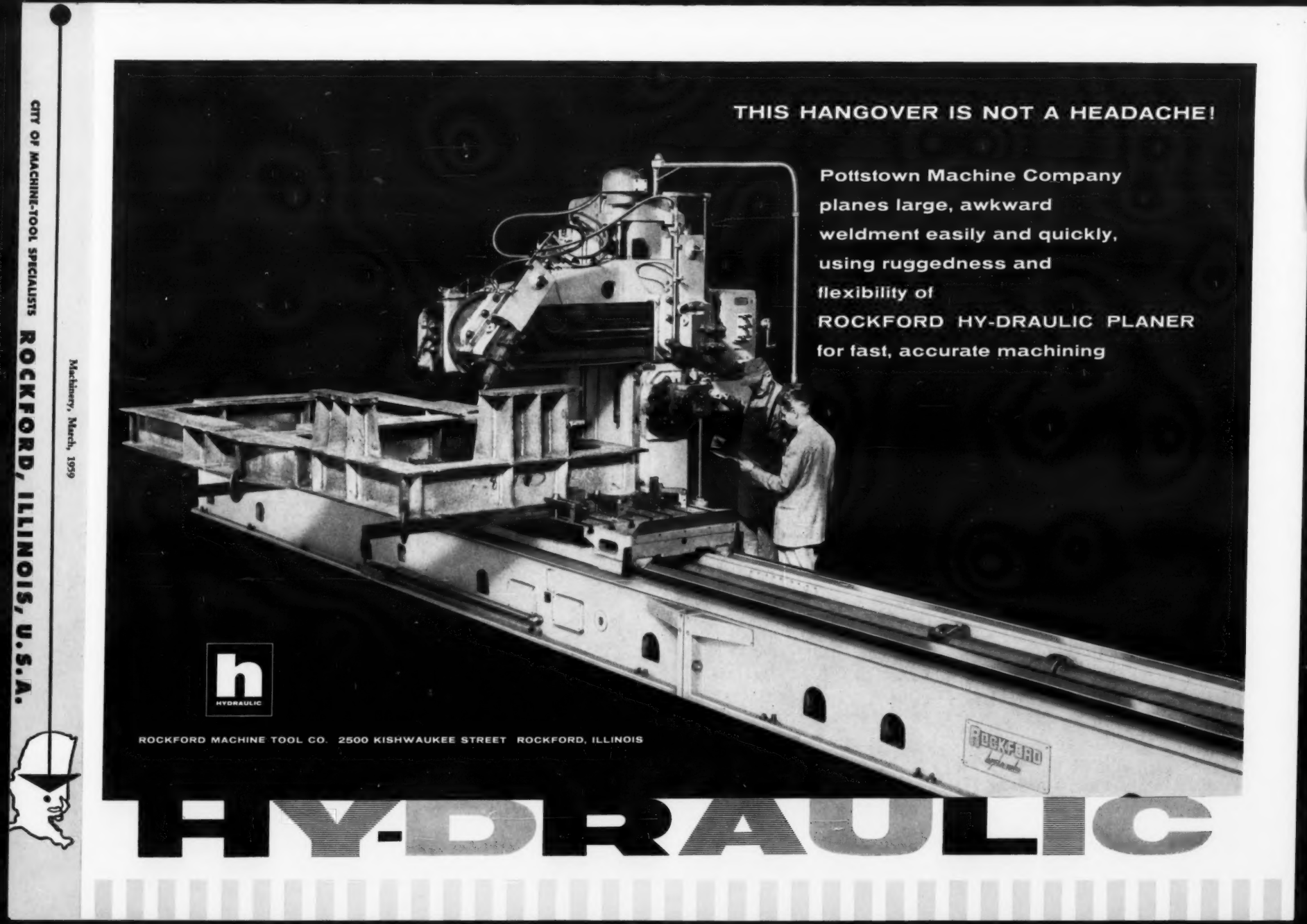
HIGH-POWERED PRECISION SURFACE GRINDERS

CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**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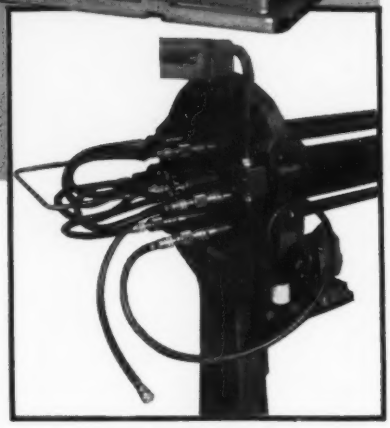
Machinery, March, 1959

MULTIPLE FEED-OUTS...



A Natural

on Greenlee Air-Feed Automatics

Feed Out Stock to 16½"
Eliminate Pushers and Feed-Out Cams

Removable fittings attach air lines to the stock reel tubes. A vacuum pump withdraws the piston when restocking. Push-button control panel is provided for starting and stopping.

Greenlee Air-Feed Automatics offer you a 3-way profit advantage:

1. Maintenance and change-over time is reduced by eliminating stock pushers, feed tubes and feed-out cams.
2. Stock can be automatically air-fed to position in one or more machining stations permitting two or more pieces per cycle.
3. Multiple feed-out flexibility enables you to finish machine a variety of pieces that ordinarily demand costly second operation setups.

If you are running into production headaches on a specific job, Greenlee may be able to adapt an "Air-Feed" to solve your problem. See your Greenlee Distributor.

Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

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Multiple-Spindle Drilling and Tapping Machines

Transfer-Type Processing Machines

Six and Four-Spindle Automatic Bar Machines

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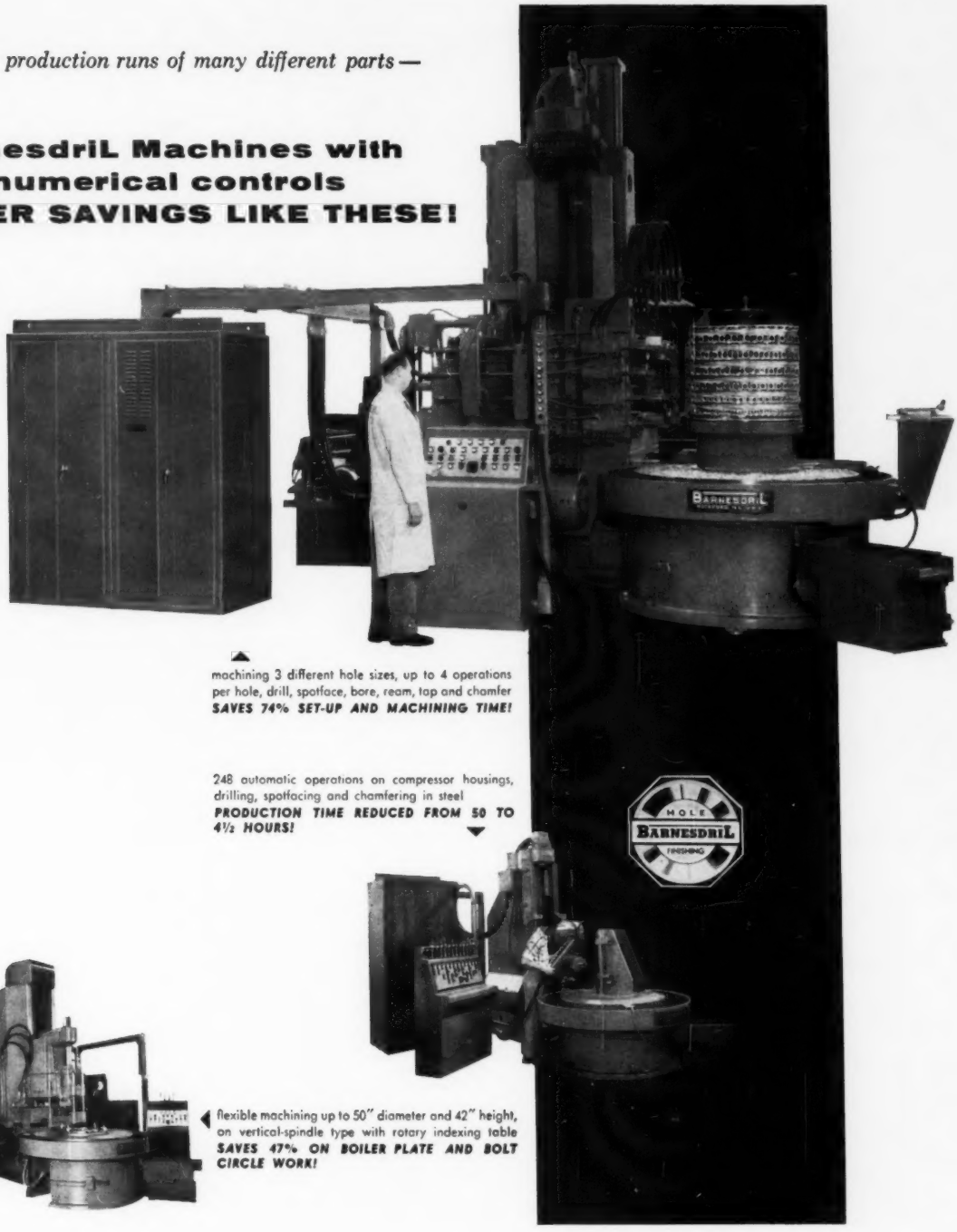
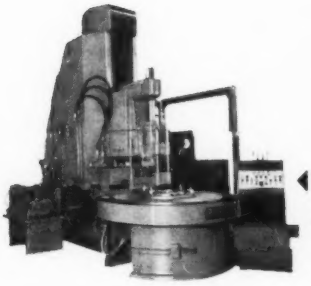
BarnesdriL Machines with G-E numerical controls OFFER SAVINGS LIKE THESE!



machining 3 different hole sizes, up to 4 operations per hole, drill, spotface, bore, ream, tap and chamfer ***SAVES 74% SET-UP AND MACHINING TIME!***

248 automatic operations on compressor housings, drilling, spotfacing and chamfering in steel ***PRODUCTION TIME REDUCED FROM 50 TO 4½ HOURS!***



flexible machining up to 50" diameter and 42" height, on vertical-spindle type with rotary indexing table ***SAVES 47% ON BOILER PLATE AND BOLT CIRCLE WORK!***

Flexible automation reduces costs where short production runs of different parts are required. For comparison of your costs, write for full details on these machines.

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CITY OF MACHINE-TOOL SPECIALISTS **ROCKFORD, ILLINOIS, U.S.A.**

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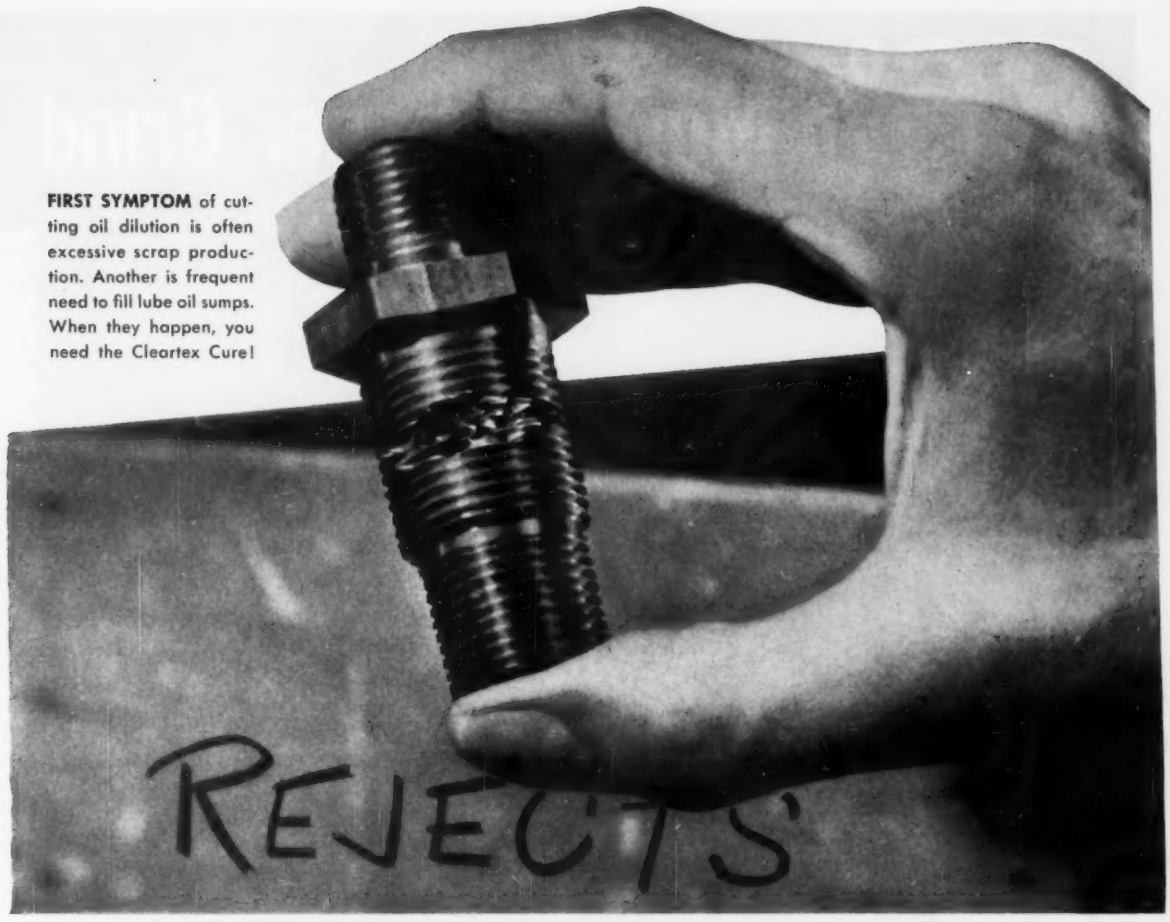

FIRST SYMPTOM of cutting oil dilution is often excessive scrap production. Another is frequent need to fill lube oil sumps. When they happen, you need the Cleartex Cure!

Diluted cutting oil can pile up rejects

When you find your scrap production soaring, the villain may be lube oil leaking into the cutting oil sumps of your automatic screw machines. It happens in 7 out of 10 automatics in spite of the most careful lubricating techniques. This dilution will lower cutting oil effectiveness—and, as it loses its efficiency, rejects pile up, tool life drops, and production can go down by as much as 33 per cent!

Texaco Cleartex can solve the problem—forever!
Because of its exceptional stability and load-carrying ability, Cleartex can function *both* as a cutting oil *and* as a lubricant —and even as a hydraulic fluid. When *all* your automatics' sumps are filled with Cleartex, unavoidable leakage is no longer a problem. Excessive scrap production will stop, tools will last longer and production will go up.

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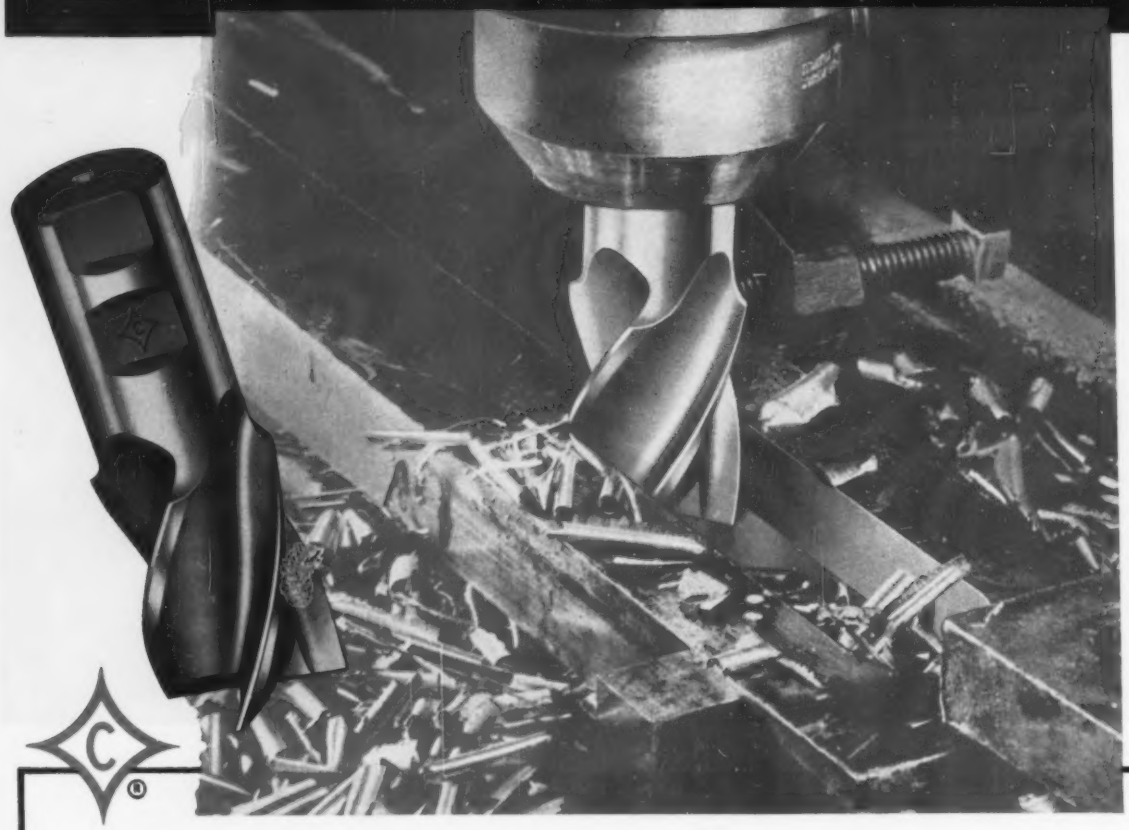

CLEVELAND 500 Series 4-Flute End Mills give Better Performance

On the job illustrated above, conventional 3-flute end mills were averaging 50 slots per grind in SAE 1020 steel. On the same set-up CLEVELAND 500 Series 4-Flute End Mills, with less cutting edge wear and longer size life, increased production to *93 slots per grind.* Yet this is only part of the story. The customer reported that these new CLEVELAND End Mills also gave a smoother finish, greater accuracy and better chip removal *without sacrificing speed or feed.* When you use CLEVELAND 500 Series End Mills you get *all* the advantages of 4-flute mills—and plunge cutting, too! Contact your nearest Stockroom, or . . .

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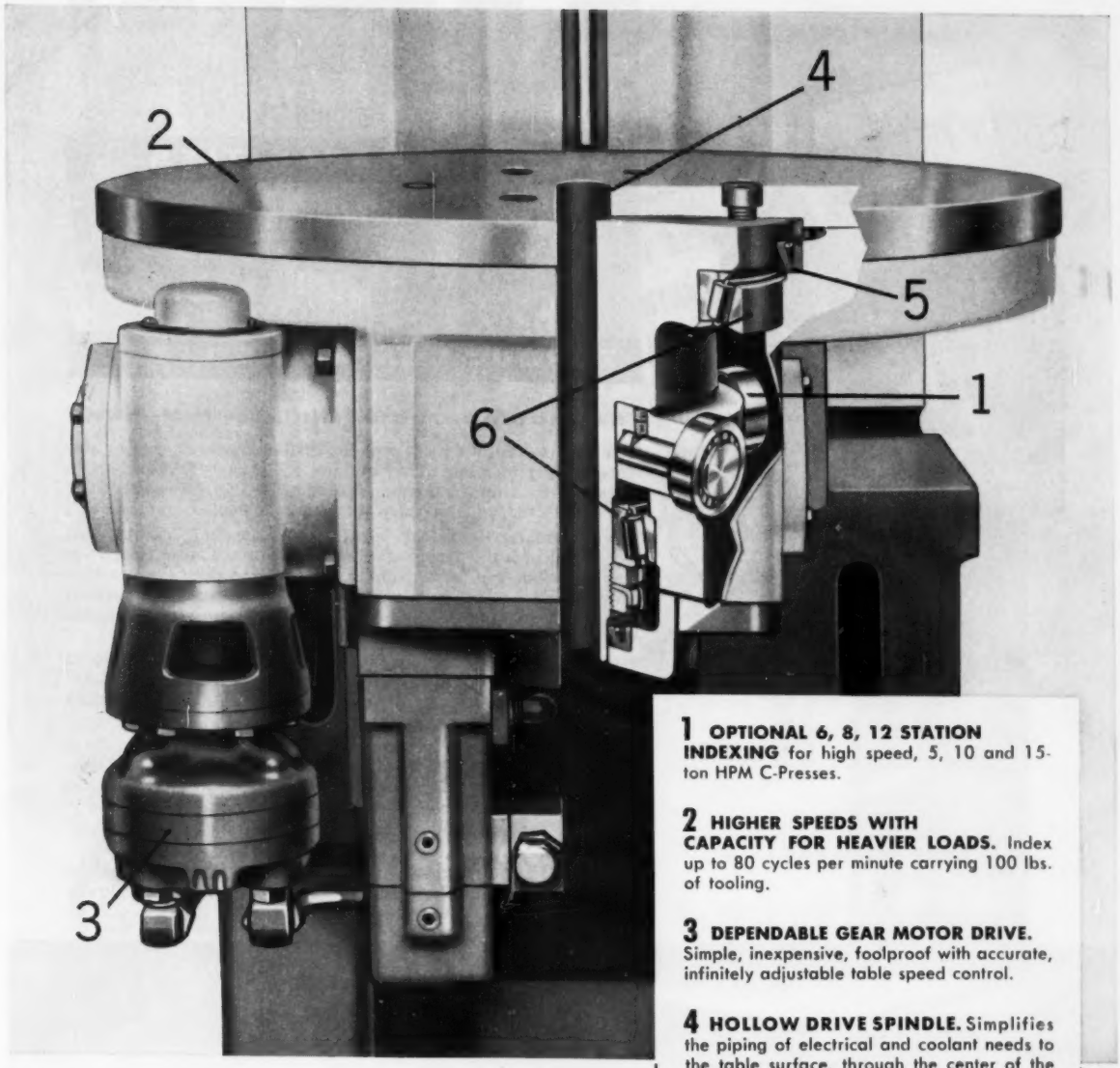

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2 HIGHER SPEEDS WITH CAPACITY FOR HEAVIER LOADS. Index up to 80 cycles per minute carrying 100 lbs. of tooling.

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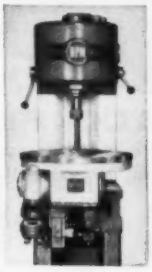

7 ACCURACY. Each index of the table locks in work position with an accuracy of .002".

8 SIMPLIFIED MAINTENANCE. COMPLETELY J.I.C. Standard foot-mounted motors, exposed pump, hydraulic motor and valving are easily accessible.

Eight production advantages standard at no extra cost

Here it is . . . the new H-P-M index table press combination, for production men charged with getting more return for their invested dollar. It's fast, accurate and completely J.I.C. with many other worthwhile production advantages. Check the outstanding features at the right . . . our offering for the best buy on the market.

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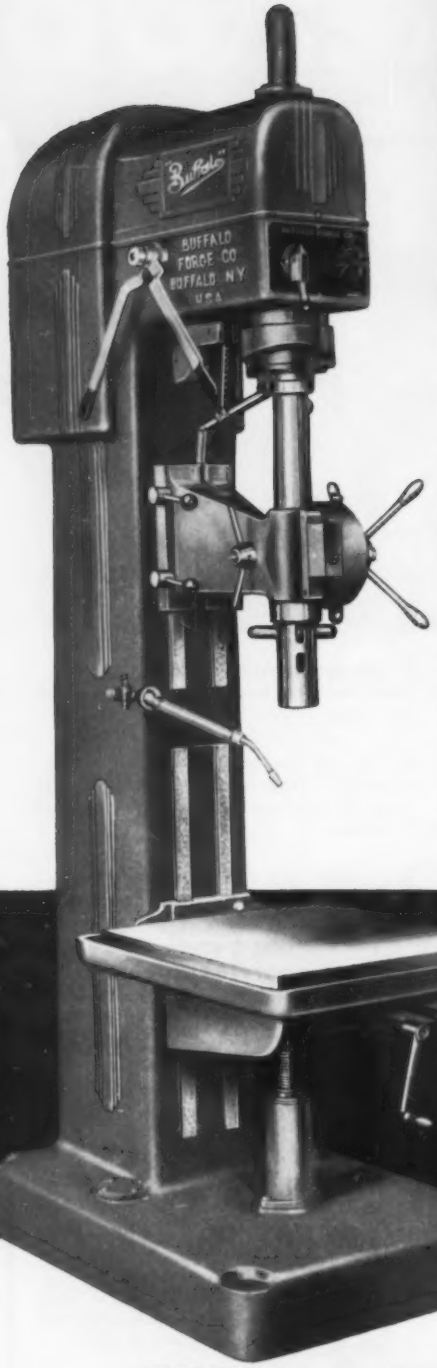

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Here is more drilling ability per dollar than competitive equipment ever offered. You'll still find the same forward-looking "Buffalo" engineering features . . . the same husky, long-life construction that's typical of "Buffalo" products.

But you'll like these new machines most of all when you try them out. Because only by operating the new "Buffalo" R-P-Mster Drills can you really appreciate the new concept of drilling ease and smoothness that you know will please your operators . . . that is certain to increase the quality, quantity and profitability of your output.

Phone your nearby "Buffalo" machine tool dealer today. He'll be glad to arrange a demonstration of the new higher capacity, lower priced "Buffalo" R-P-Msters. Or write us direct for Bulletin 3257-C.

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double value

from "DOUBLE LO-HUNG" SPINDLE DRIVE . . .

"AMERICAN" Hole Wizards Provide:

1. ***High spindle speeds at low gear velocities.***
2. ***Heavy drilling, boring and large tapping speeds at low tooth pressures.***
3. ***Faster tapping through spindle reverse speed-up.***

The "Double Lo-Hung" Spindle Drive is an exclusive "AMERICAN" Hole Wizard feature. This drive divides the speed range into two separate ranges; the high speeds through a small gear to minimize gear velocities; the low speeds through a large gear to reduce gear tooth pressures under severe service.

This design in combination with its nitrided Spindle and Sleeve, Timken Mounted with outside adjustment for Spindle Bearings, guarantees maximum life, dependable operation and spindle stability for "AMERICAN" Hole Wizards unequalled by other designs.

• ***Bulletin No. 328 tells the story***

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● A smaller (14" x 42" or 14" x 48" table) heavy duty, high precision surface grinder with controls at eye level retaining all the features that have made HILL horizontal spindle hydraulic surface grinders famous for precision production during the past twenty years. This is an entirely NEW grinder brought out at your request to compliment the line of HILL heavy duty surface grinders of larger sizes. Where initial cost and limited floor space are critical factors we believe that this new, smaller HILL grinder will solve your finer finishing problems. Full details are given in bulletin 58GS.

HILL Horizontal Spindle grinder with fully hydraulic table and cross feeds. Size: 14" x 42" table with 16" clearance. Magnetic chuck is standard equipment.

Of course we still make the full line of HILL horizontal spindle and vertical spindle grinders in the larger sizes with table lengths from 5 to 20 feet.

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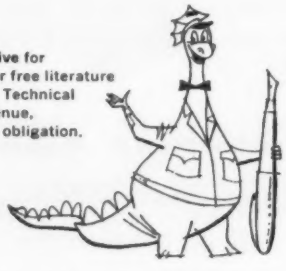

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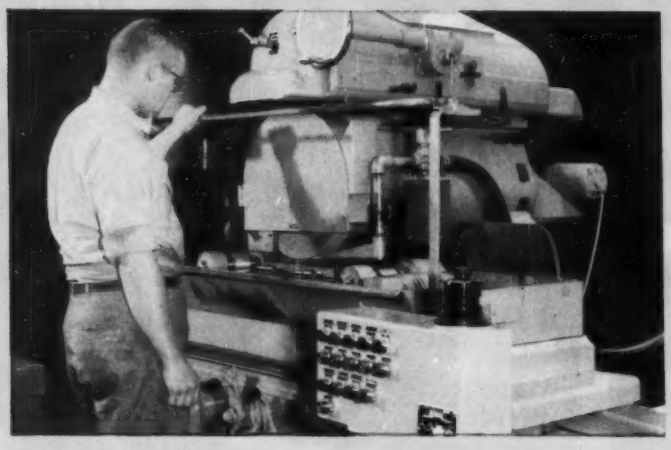
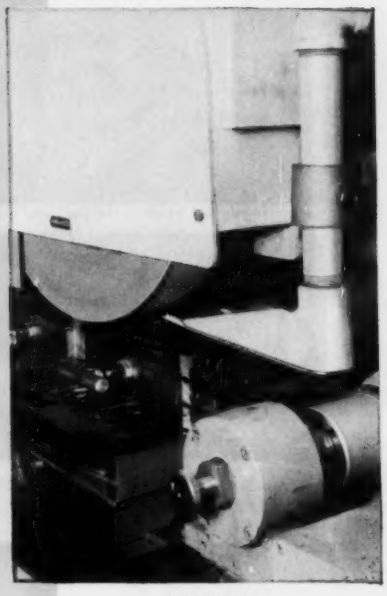




In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

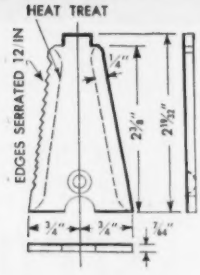
The installation of the Thompson Truforming Grinder has accomplished the following results:

1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

**Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.*



LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

"Keep Thompson in mind for that daily grind"

THE THOMPSON GRINDER CO.
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Thompson SURFACE GRINDERS

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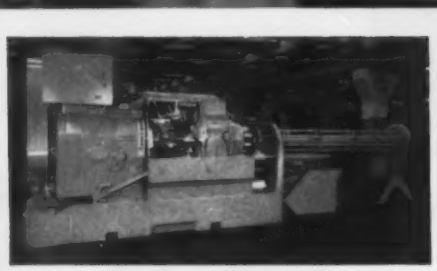

Acme-Gridley, 1¼" RB 8 producing 690 nozzle bodies per hour

Close-up of tooling zone showing 5th, 6th and 7th positions.

ACME-GRIDLEY ELIMINATES SECONDARY OPERATIONS...

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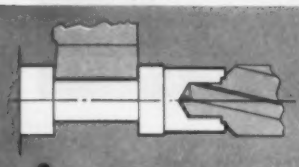
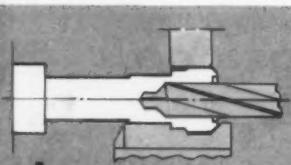
- Direct Cost Reduced 48%*
- Production Time Reduced 64%

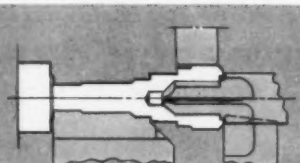
* Details on request



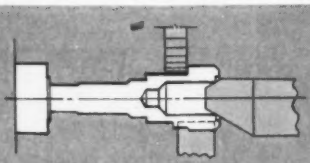
8. Feed out—rough form rear diameter—counterbore and drill large hole part way



1. Form two front diameters and chamfer head—drill large hole remainder—support



2. Form two rear diameters—ream large hole—face end—support



3. Stop spindle rotation—mill flat—support

As a part of a continuing contribution to all phases of cost reduction, National Acme engineers initiated the development work necessary to effect important savings for this 65 year old Wellsburg, W. Virginia company.

The aluminum nozzle body of their hydraulic pump oilers formerly had been produced on a six spindle automatic and two other machines performing secondary operations. Visionary machine tool engineering made possible the application of spindle stopping and positioning on an eight-spindle Acme-Gridley to complete the entire piece *in the primary set-up . . . and increase net production.*

Advanced design and development such as this, together with wide open tooling zones, independently operated tool slides and the extreme accuracy and flexibility of direct camming . . . makes possible the solution of "unusual" jobs an "every day" occurrence at National Acme.

Write or ask one of our representatives for the complete story on the industry's most modern approach to *your* cost reduction problem.

NATIONAL ACME'S
"ZONE OF RESPONSIBILITY"
INCLUDES ALL PHASES OF COST REDUCTION

Check YOURS...Then Check National Acme

Direct Costs: these include direct dollar savings as realized by the Eagle Manufacturing Company . . . an "every day" job for Acme-Gridleys.

Indirect Costs: effecting important savings in maintenance, downtime, scrap reduction, tool costs, etc.

Product Redesign: teaming with your design group to take full advantage of Acme-Gridleys' cost reducing capabilities.

Direct Material Costs: our engineers provide important savings in this area by constantly matching machines and tools to modern metallurgical problems.

Make-or-Buy Reviews: in many cases our Contract Division can assume your production headaches and relieve you of immediate capital investment.

Spot Modernization: pioneering in modern tooling methods, and the flexibility of Acme-Gridleys can provide many "on-the-spot" savings.

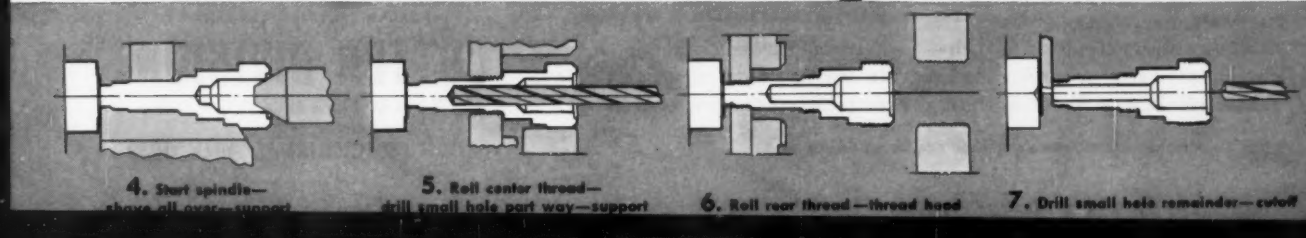
National Acme

The National Acme Company
179 E. 131st Street
Cleveland 8, Ohio

Sales Offices: Newark 2, N.J.; Chicago 6, Ill.; Detroit 27, Mich.

Pioneer in Circumferential Automation

15 Operations in 5.5 Seconds



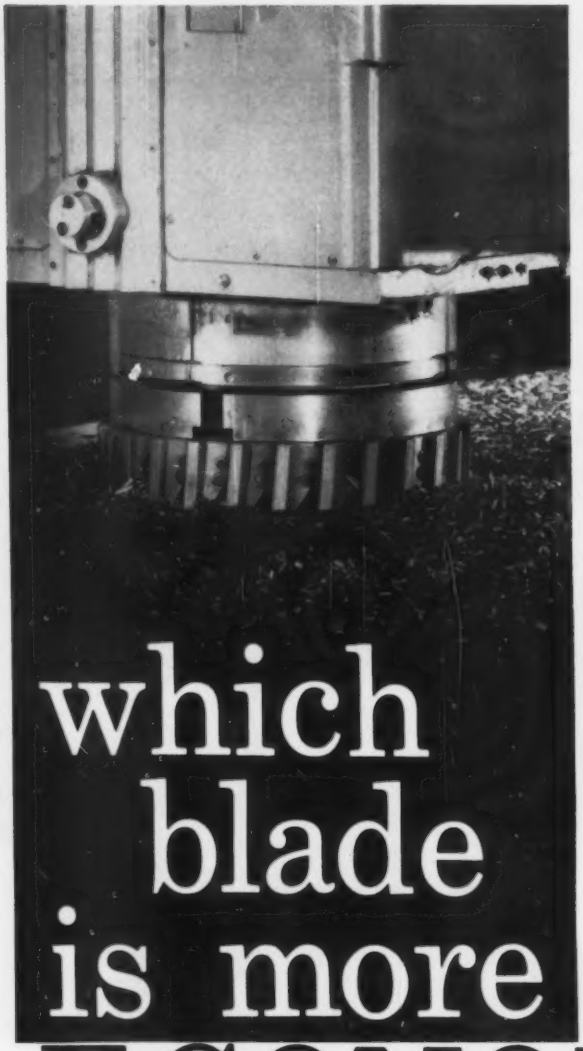
4. Start spindle—shave all over—support

5. Roll center thread—drill small hole part way—support

6. Roll rear thread—thread head

7. Drill small hole remainder—cutoff

high speed steel or carbide...



which blade is more ECONOMICAL?

Even in the most ordinary milling and boring work, fields of application have a habit of overlapping. And, as a result, choice of the most economical and efficient blade material can often be a challenging problem.

Solutions to machining problems like these are our primary product. You don't buy Ingersoll cutters, as such—or high speed steel or carbide blades. What you buy is lower operating costs and improved finish. You buy increased productivity!

Only after a thorough study of your machine, work piece, depth of cut, speed, feed rates and finish requirements do we recommend any cutter. And we assume full responsibility for every recommendation we make.

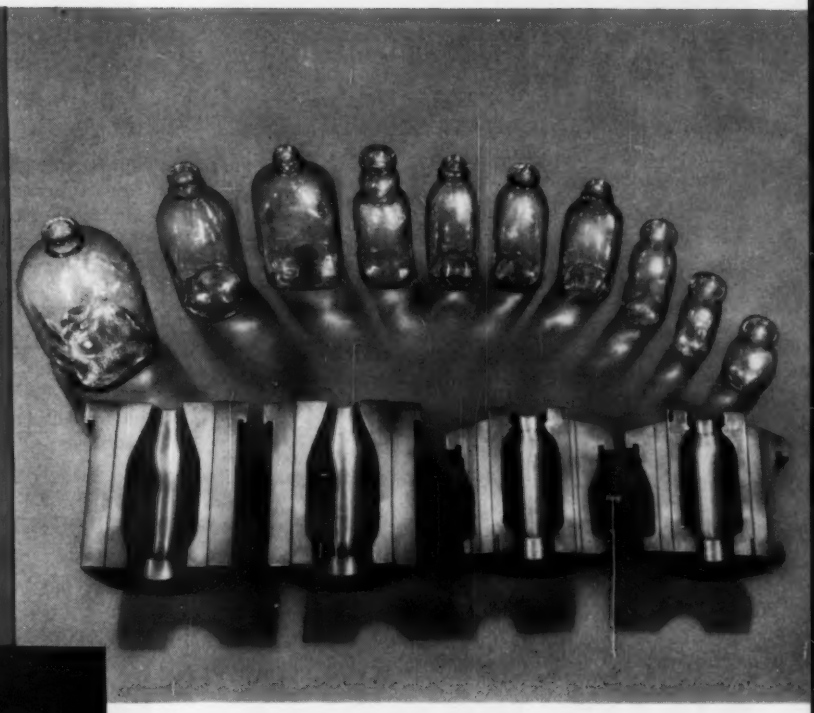
We would welcome the opportunity to tell you more about this unique cutter selection service. Write:

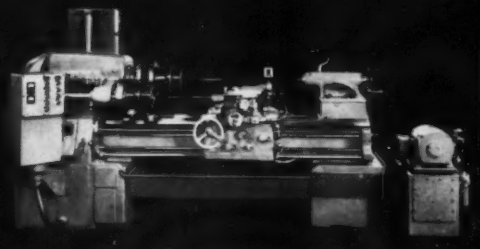
This helpful new booklet tells you how to reduce the cost of chips and improve your milling and boring performance. Ask for a free copy of booklet No. 68B.

THE
INGERSOLL
MILLING MACHINE COMPANY
CUTTER DIVISION
505 FULTON AVENUE • ROCKFORD, ILLINOIS

Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes

MONARCH'S SPECIAL-PURPOSE LATHES OF TOMORROW...





1..The New Rotary Profile Tracer Lathe for Non-Circular Cross-Section Work

Up to *three times* more productive than equipment now in common use! Hand finishing drastically reduced! This new Monarch says "Lower Costs" two ways—on circular or non-circular cross-section work, such as the bottle molds above.

It has speed and accuracy that's only been a dream till now. Featuring the new Monarch supersensitive electro-hydraulic tracer, it delivers accuracy of duplication of ±.001" when the tool is traveling at a 100" per minute rate. At only a slight increase of error, tool travel up to 300" per minute is possible.

Stylus deflection pressure is a low 1½ ounces. Electrical amplification of its movement instantly translates work contour change into hydraulic slide movement.

As you see, the master spindle is mounted at the front of the machine for ease of setup and operation. There's a positive gear drive from the headstock spindle through a quadrant-mounted idler which may be adjusted to eliminate any backlash between the lathe spindle and the master.

Want your costs to plunge downward? If that isn't worth a letter of inquiry—what is? *The Monarch Machine Tool Company*, Sidney, Ohio.

Monarch
TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

For more data, circle this page number on inquiry card

Announcing for the missile era:

3 new toolroom aces

Accuracy to the split-tenths

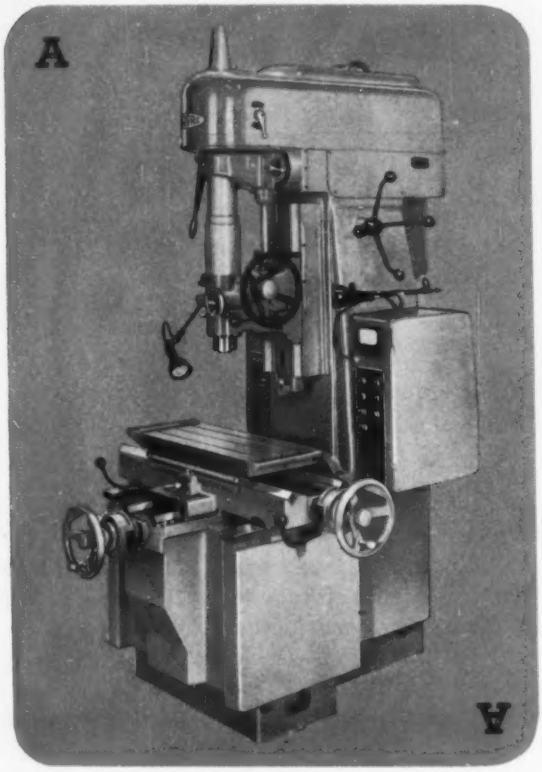
FLASH!

All Moore machines shipped after February 15, 1959 are made and calibrated to the New International Inch

LOCATES AND BORES HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Borer

For boring, drilling, reaming and spotting holes in dies, jigs and production parts, the speed and accuracy of the Moore Jig Borer has never been equaled. Now, with this new and larger No. 3 model, you will break the "tenth" barrier! Here's why: it offers more precise positioning tolerances...all hardened, ground and lapped ways...no gibs...no overhang...improved drive... wider speed range, 60 to 2250 RPM...larger table working surface, 11" x 24"...micro setting of vernier dial... more accessible cross-clamping. These new features, plus sensitive, centralized controls for spindle speeds and feeds, quick tool-changing, easy lubrication add up to a Jig Borer which belongs in every toolroom where *tomorrow's* accuracies must be achieved *today!*



DETAILED LITERATURE ON EACH OF THESE MACHINES IS AVAILABLE ON REQUEST.

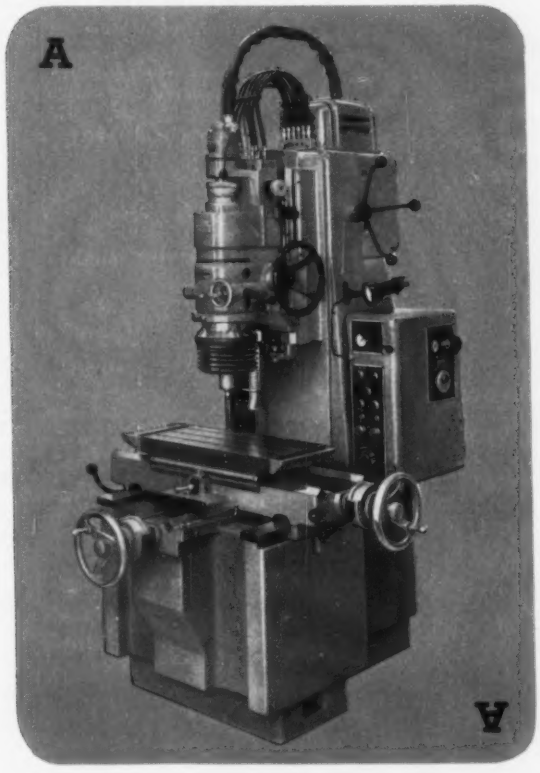
MOORE TOOLS BRIDGEPORT, CONN.

Manufactured by

LOCATES AND GRINDS HOLES TO LESS THAN A "TENTH"

No. 3 Moore Jig Grinder

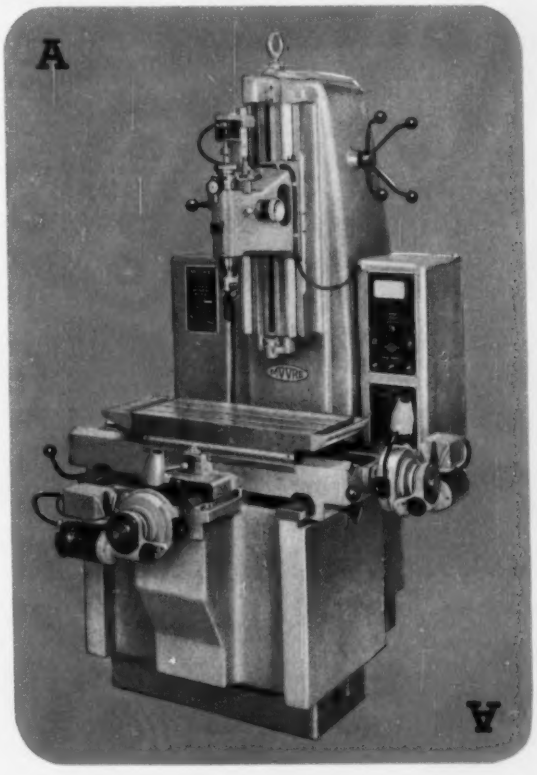
The originators of jig grinding and the Jig Grinder have done it again! Now, with this new, larger No. 3 model, you can grind—*with split-tenth accuracy*—holes plus regular and irregular contours to size and location after hardening. This is made possible by the closer locational tolerances built into the machine...by the all-hardened-ground-and-lapped ways...by the faster strokes provided for chop-grinding...by the infinite spindle speeds, 40 to 250 RPM...by the larger table working surface, 11" x 24". The same quickly set precision lead screws as in the Moore Jig Borer simplify the finish-grinding process.



MEASURES TO ONE-THIRD OF A "TENTH"

Moore Universal Measuring Machine

This machine, built on the same basic principles as the No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder, introduces a new concept in ultra-precise measurement and inspection. It offers *for the first time:* A machine combining the capacity for larger work-pieces; choice of electronic indicator supported on an accurate, rotatable spindle, or a universal microscope for pickup; a combination of rectilinear and angular positioning, making possible the measurement of the most complex contours. Design and construction insure the highest possible accuracy. All ways are hardened, ground and lapped steel, fitted to hand-scraped cast iron. Table positioning in two directions of travel is by means of master lead screws. Note motorized lead screw drive, offered as optional equipment (available only for Measuring Machine).



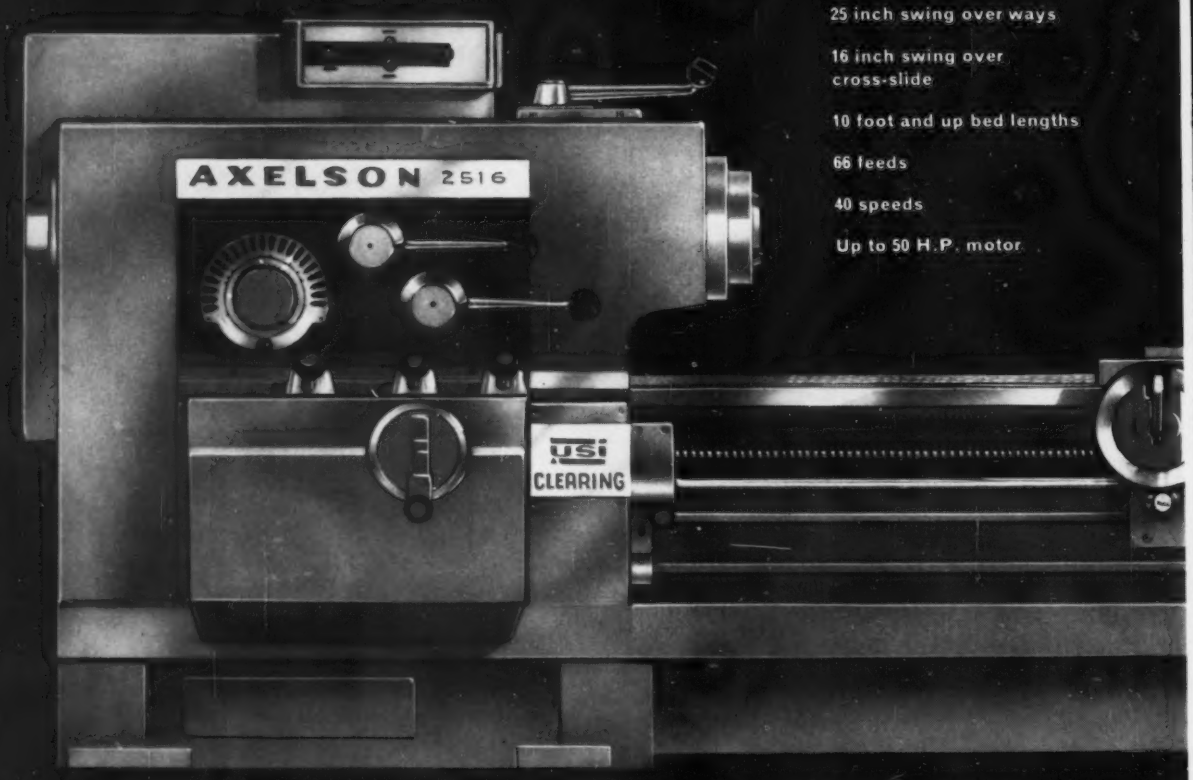
MOORE SPECIAL TOOL COMPANY, INC., Bridgeport, Conn.

For more data, circle this page number on inquiry card

THE ALL NEW CLEARING-AXELSON

The Lathe that Makes All Others Obsolete

A Startling New Concept in Lathe Design



25 inch swing over ways

16 inch swing over cross-slide

10 foot and up bed lengths

66 feeds

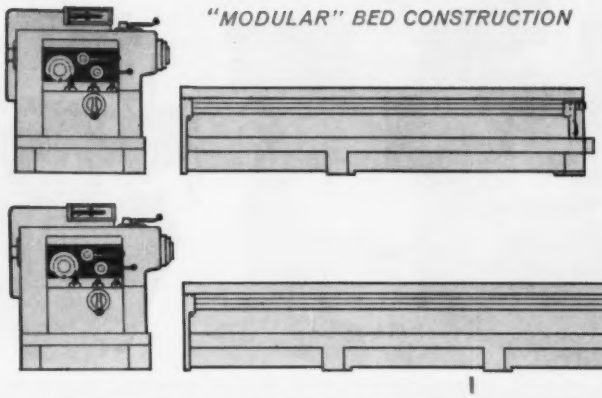
40 speeds

Up to 50 H.P. motor

The new Clearing-Axelson is not just a face-lifting redesign. Rather, it is a completely new approach to lathe design and construction. Historically, lathes have been designed around cast beds with the headstock placed on top of the bed. In the new Clearing-Axelson, the headstock is a complete unit, built to the floor. The bed is a complete unit built to the floor.

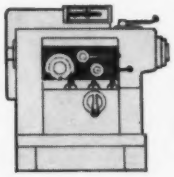
Construction is welded steel—far stronger than cast iron, and much more suitable for the addition of accessory tooling.

Performance? There has been nothing like it since lathes were first developed. The features shown here are just a part of the story. When you have seen this machine, you will know you have seen the future in engine lathe design . . . the Clearing-Axelson.



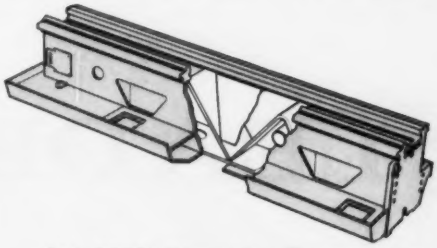
"MODULAR" BED CONSTRUCTION

Beds are keyed and bolted to the headstock. The bearing surfaces are machined to guarantee rigid accurate alignment of bed, headstock and spindle, assuring precision and interchangeability. If at a later date you need a longer or different style bed, you needn't buy a new lathe—just order a new bed. ***Here is the building block concept—no problem of obsolescence!***



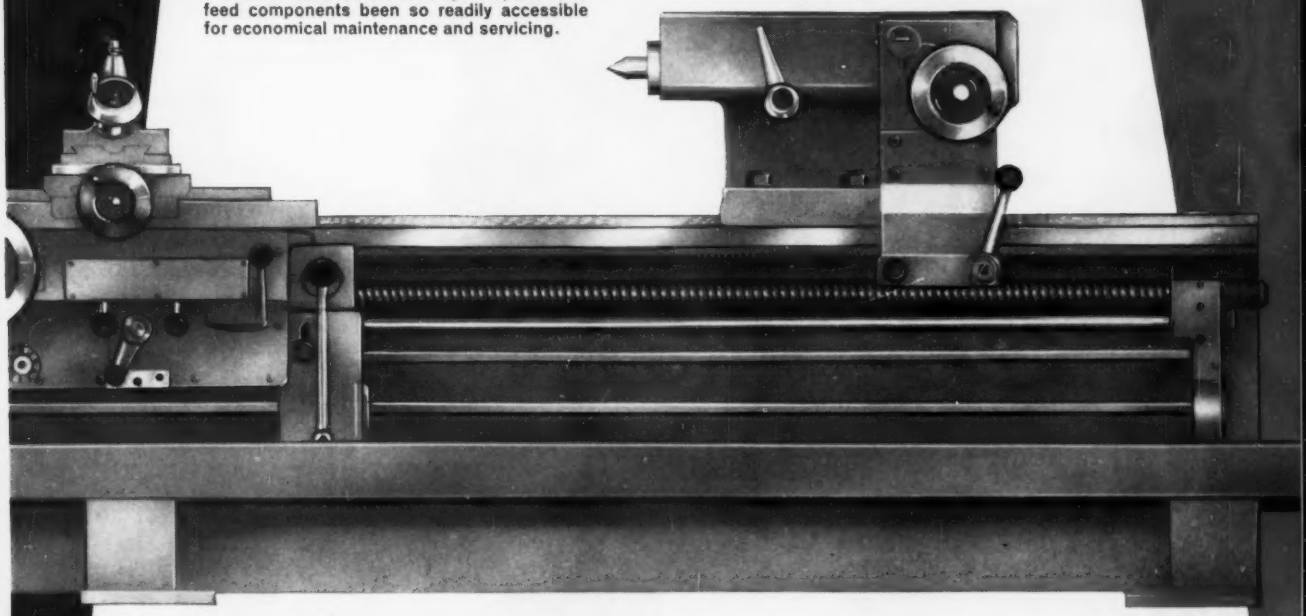
"MODULAR" HEADSTOCK CONSTRUCTION

The headstock is a modular assembly in which both the main drive and the feed box may be easily removed as units by a simple disassembly. Never before has it been easier for the user to change the entire speed or feed range of a lathe. Never before have spindle, drive and feed components been so readily accessible for economical maintenance and servicing.



ALL STEEL WELDED BED—18 TIMES STRONGER THAN CAST IRON

Stronger homogeneous steel plate provides strength where it is needed—with none of the limitations of cast iron design. Pyramid shaped reinforcing ribs are used the entire length of the bed for high torsional rigidity.



Clearing, division of U. S. Industries, Inc. also manufactures power presses of all types, dies and special tooling, and special equipment for the aircraft and missiles industry.

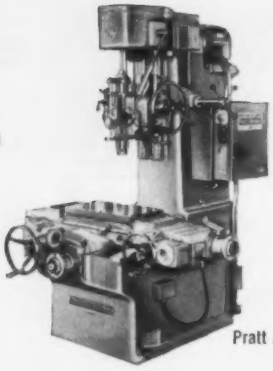
usi Clearing

DIVISION OF U.S. INDUSTRIES, INC.

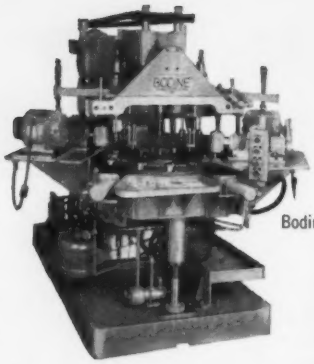
6499 W. 65th Street • Chicago 38, Illinois

Plants in: Chicago, Los Angeles, Hamilton, Ohio

Hartford Special



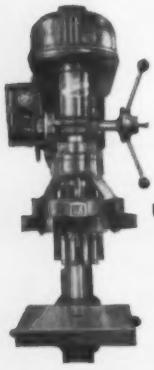
Pratt & Whitney



Bodine

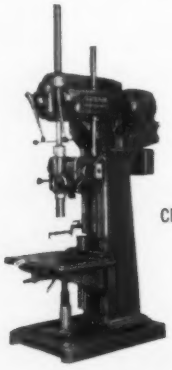
18 LEADERS

stake their reputations on

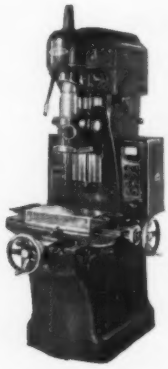


U. S. Drill Head

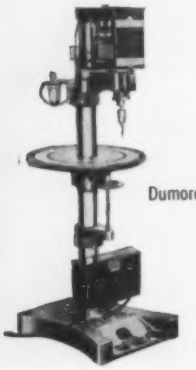
Greenlee



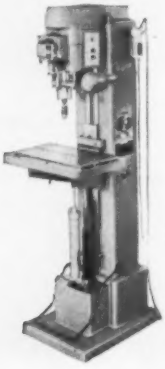
Cleereman



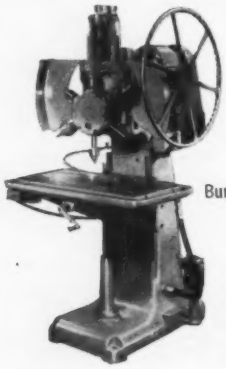
Moore



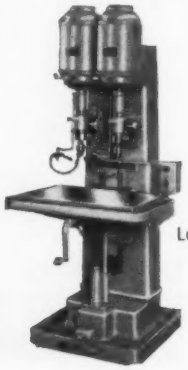
Dumore



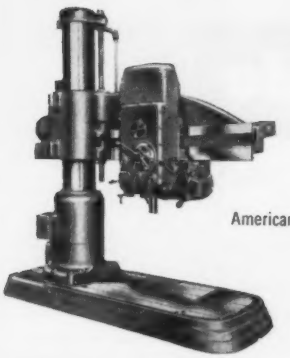
Snow



Burg

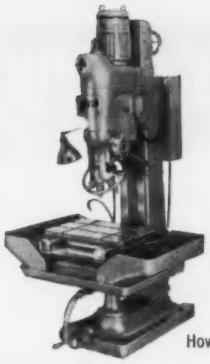


Leland-Gifford

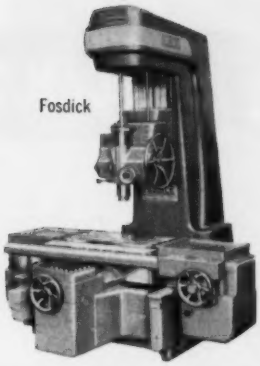


American

Edlund



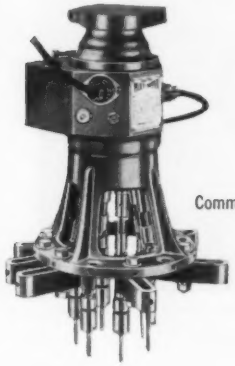
Howe & Fant



Fosdick

Jacobs CHUCKS

Chicago Quadrill



Commander

Jarvis

INDUSTRIAL DISTRIBUTORS · SERVING INDUSTRY ECONOMICALLY · THE RIGHT HAND OF PRODUCTION

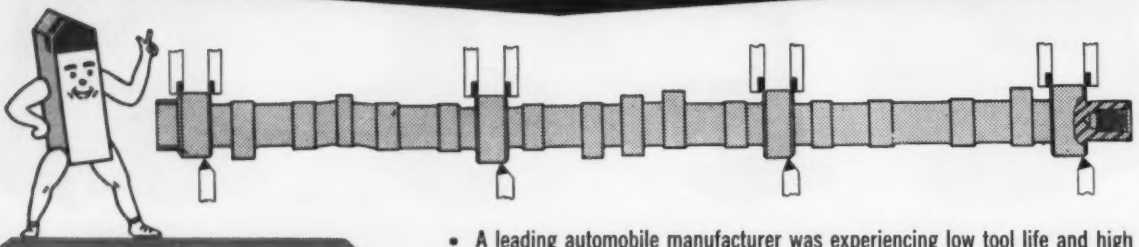
A PARTNERSHIP IN PROGRESS

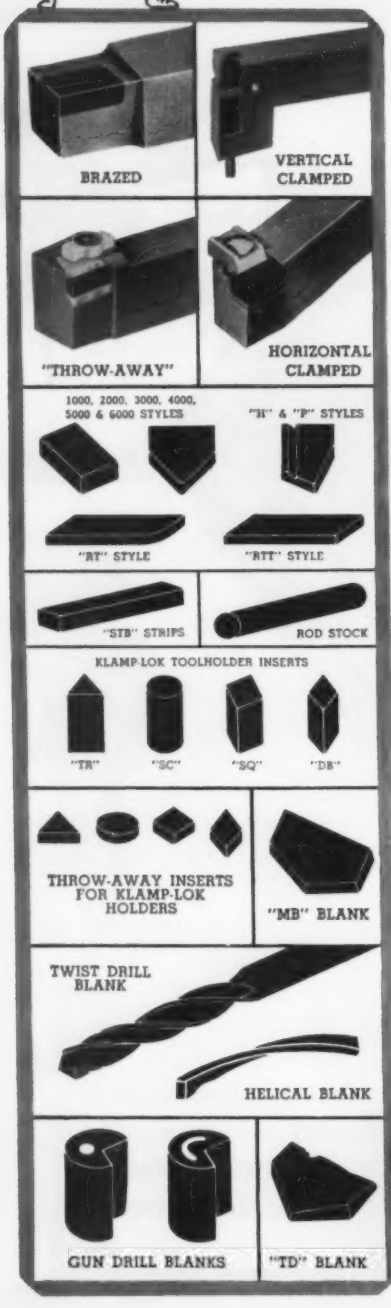
Your industrial supply distributor makes it his business to know your business. He is always available and ready to fill your needs quickly, dependably and economically. When you need chucks, you can depend upon Jacobs and the Jacobs industrial supply distributor who works with you . . . your partner in progress through service.

THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT

For more data, circle this page number on inquiry card

1020 CAMSHAFTS MACHINED WITH Talide® C-91!





• A leading automobile manufacturer was experiencing low tool life and high costs machining camshafts made of tough, highly abrasive ArmsSteel. Talide tool engineers installed Grade C-91 with the following superior results:

GRADE C-91 CASE HISTORY

Part..... Automobile camshaft

Material....ArmsSteel 1.8165 dia. x 23-½" long, 32 Rc hardness

Operation.. Rough turning 4 bearing surfaces

Machine....Sundstrand Model #8 automatic

Tools.....4 Talide TB-123 ⅜" I.C. x 1-½" long triangular inserts, Grade C-91, mounted in Klamp-Lok toolholders

Depth of Cut..1/16" to 3/32"

Feed.....012

Speed.....130 (S.F.M.) 274 (R.P.M.)

Coolant.....Soluble Oil

Results....Talide Grade C-91 machined 1020 camshafts per grind compared to 550 for 2nd best competitive grade and 275 for 3rd best. Special attention to the grind and chip breaker detail resulted in Grade C-91 outperforming all other grades used previously.

QUALITY CONTROL GUARANTEES TOP TOOL PERFORMANCE . . .

Determining rupture strength of test bar. Hardness is determined on Rockwell machine, center.

Leco and Burrell instruments are employed in the analysis of metal oxides.

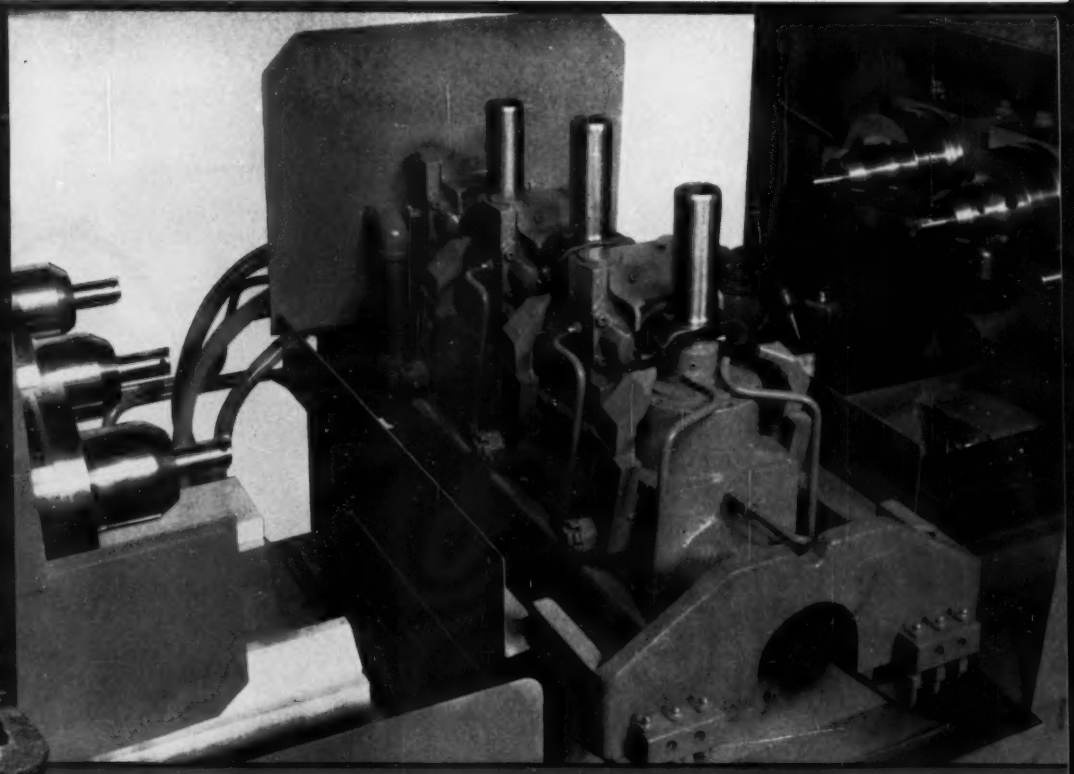
• A constant research program at Metal Carbides pays off in improved Talide grades having extra high hardness, strength, rupture resistance and crater resistance properties. Processed in latest type vacuum electric furnaces—all Talide grades are uniform and consistent in quality.

Write for Catalog 56-G

METAL CARBIDES CORPORATION
TALIDE®
YOUNGSTOWN 12, OHIO

Metal Carbides Corporation
Youngstown 12, Ohio

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY



RIGHT: Vertical splined arbors and clamps holding shoulders of bores are operated hydraulically.

BELOW: Universal yoke showing two holes bored simultaneously.

Two-Way Boring Speeds Parts Production

58-9

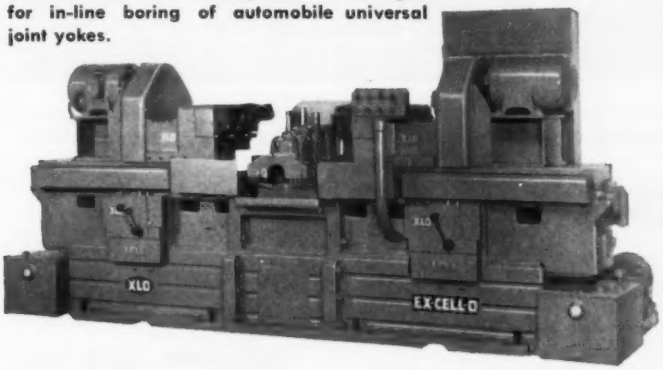
This Ex-Cell-O Precision Two-Way Boring Machine cuts production time of universal yokes for a manufacturer of automotive components by performing operations at both ends of a part—simultaneously.

Two independent machines interlocked electrically for central push-button control, the two-way unit bores two holes in line through malleable iron yokes held in a three station fixture. Both machine sections have three spindles on each slide for high production.

Two, three or four standard, self-contained way units can be easily arranged around a fixture at any angle the work requires. And like all Ex-Cell-O Precision Boring Machines, Way Machines are readily adaptable to different size workpieces—light, medium or heavy parts—and varying material requirements.

For complete information on versatile Ex-Cell-O Way Machines that can save time in your operation, contact your local Ex-Cell-O Representative, or write direct.

BELOW: Ex-Cell-O Two-Way Machine arranged for in-line boring of automobile universal joint yokes.

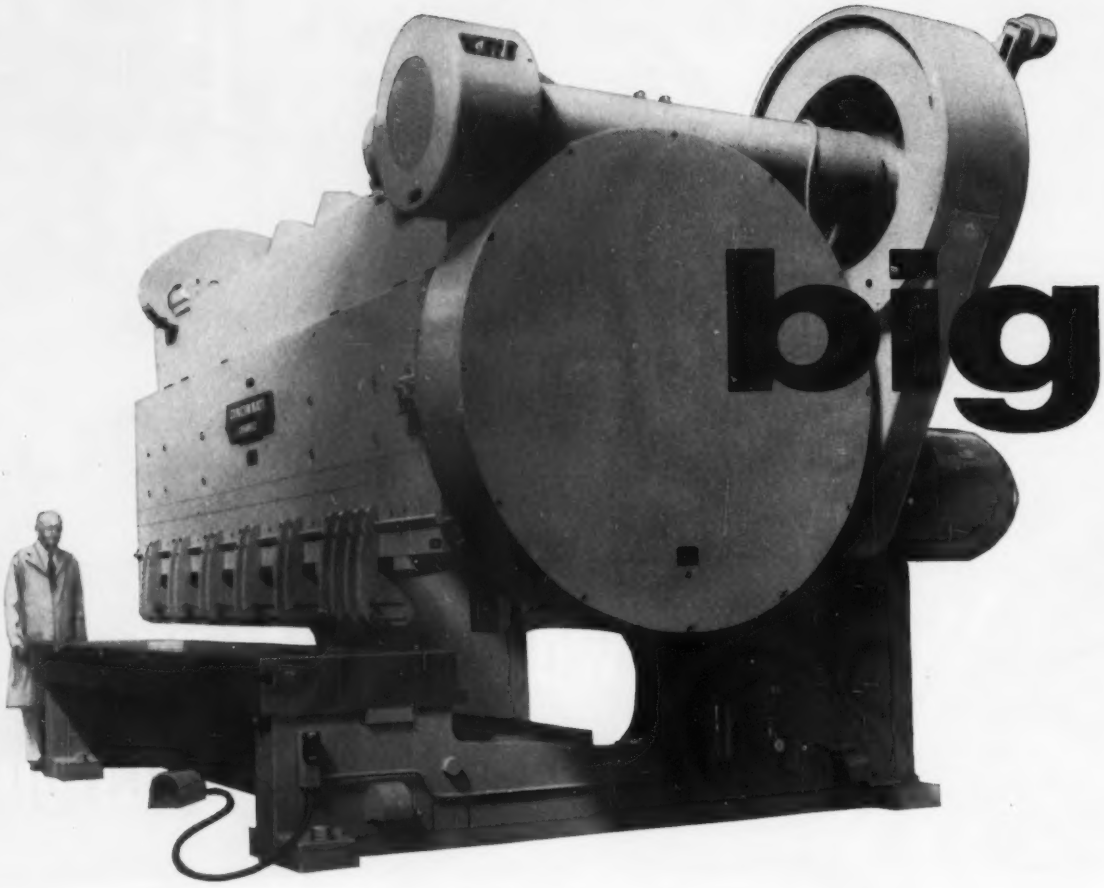


XLO EX-CELL-O FOR PRECISION

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN

Machinery Division

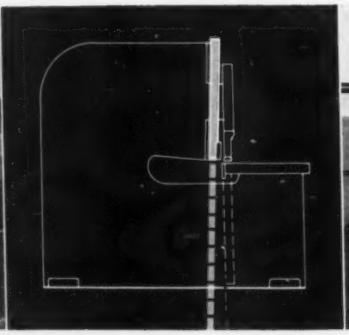
MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • TORQUE ACTUATORS RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT



Typical Cincinnati® Shears: **big** series 15012, capacity 1½″, 12′; **small** series 1004, capacity 3/16″, 4′; **in between** series 1810, capacity ¼″, 10′.

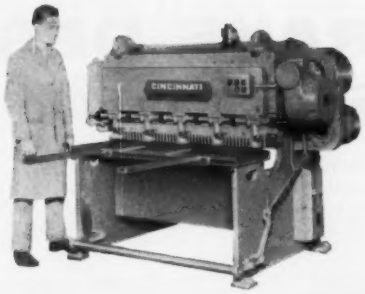
All steel, interlocked construction—no welds used as load supports

Hydraulic holddowns exert tons of pressure, insure accuracy

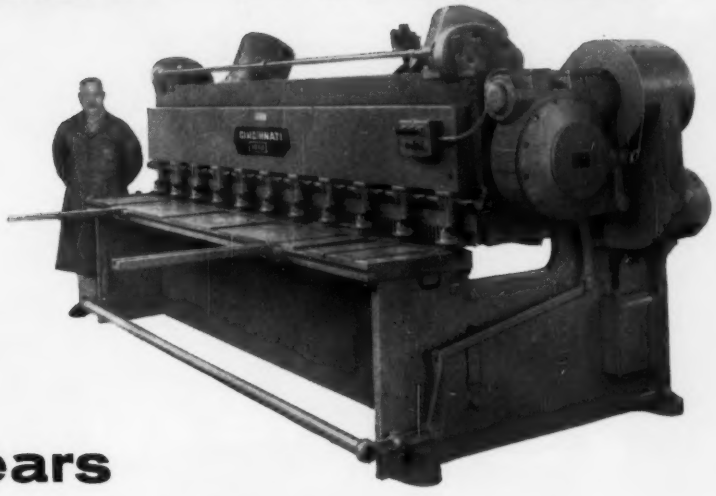


Non-float inclined ram maintains extremely accurate knife clearance

Front controlled power back gage is standard, accurate



small or in between



Cincinnati® Shears give you every advantage

Simple operation, micrometer accuracy, cost-cutting speed, all-steel construction, and versatility—these are the advantages which make Cincinnati Shears earn their way in your plant.

And, whether you're shearing steel or plastics, nonferrous metals or asbestos, wire mesh, clad metals, or even radioactive material, the Cincinnati Shear line gives you a range of choices to fit your own requirements. Cincinnati Shears are in service cutting all of these materials.

Cincinnati ruggedness enables you to use one knife clearance for all thicknesses up to machine capacity.

Power operated back gages which are standard equipment, reduce non-productive time. Hydraulic holddowns provide tons of pressure, insure accuracy. The inclined ram permits the economy of four-edged knives, keeps work from binding between back gage and lower knife.

Since gap frames are standard, you can do notching, slitting or shearing work longer than the machine on any Cincinnati® Shear to the limit of its gap.

Be sure to get the full Cincinnati story before you buy your next shear. Write Dept. D for Catalog S-7R.

Shapers / Shears / Press Brakes

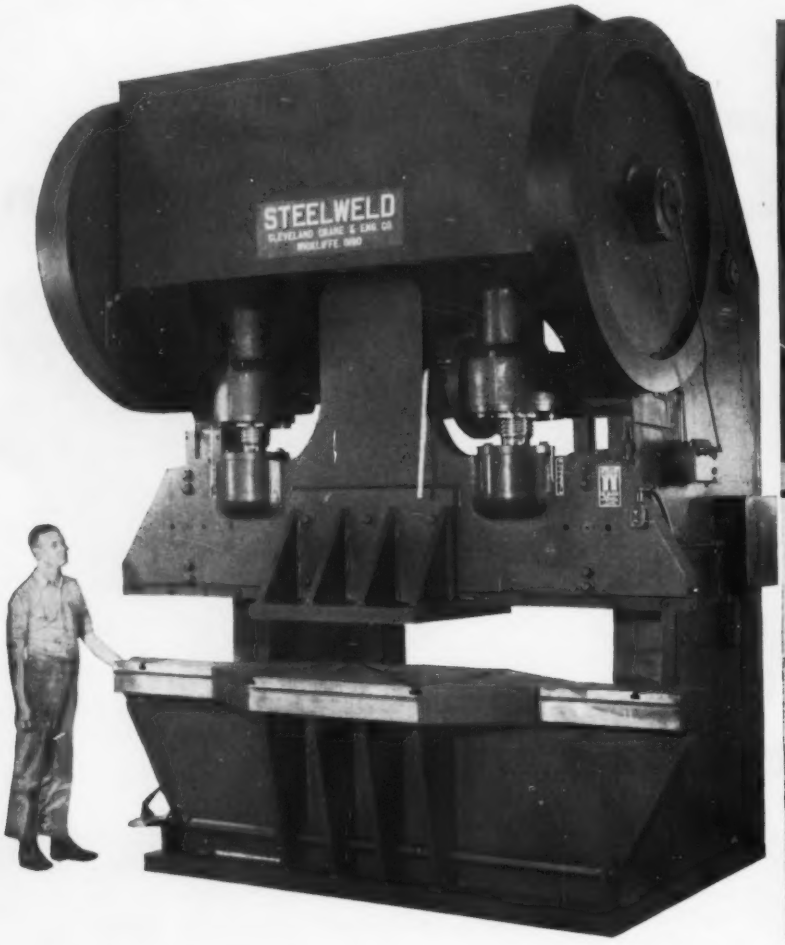
THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

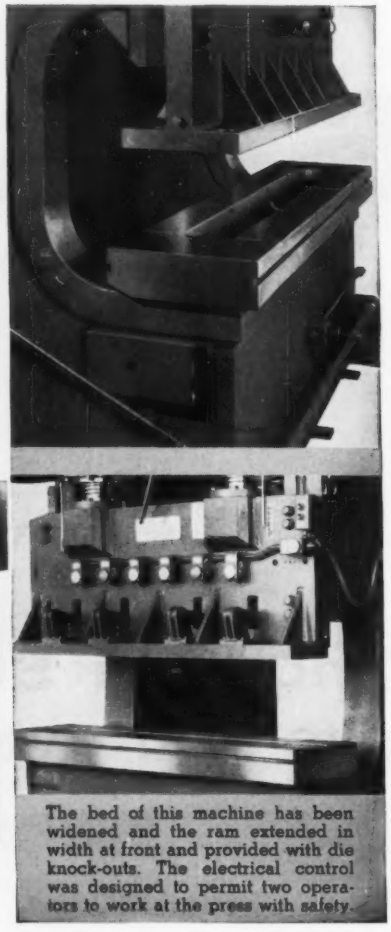
STEELWELD BRAKE DESIGN

Easily Adaptable For Special Requirements

Widening the bed of this 400 ton brake made it possible to serve a special purpose. The corresponding area of the ram was provided with a detachable ram bolster. With the bolster removed, normal brake operations can be carried on.



This Steelweld Brake was built with a double-plate bed having wide top and slot for punching purposes. This makes a low-cost press that is excellent within certain limits.



The bed of this machine has been widened and the ram extended in width at front and provided with die knock-outs. The electrical control was designed to permit two operators to work at the press with safety.

WHILE a standard press brake can handle a wide variety of metal-forming operations, often certain construction changes can be made that will permit doing work that normally would require a large costly forming press. Design changes can also be made that will speed production, improve safety or bring about other desirable advantages for specific types of work.

STEELWELD

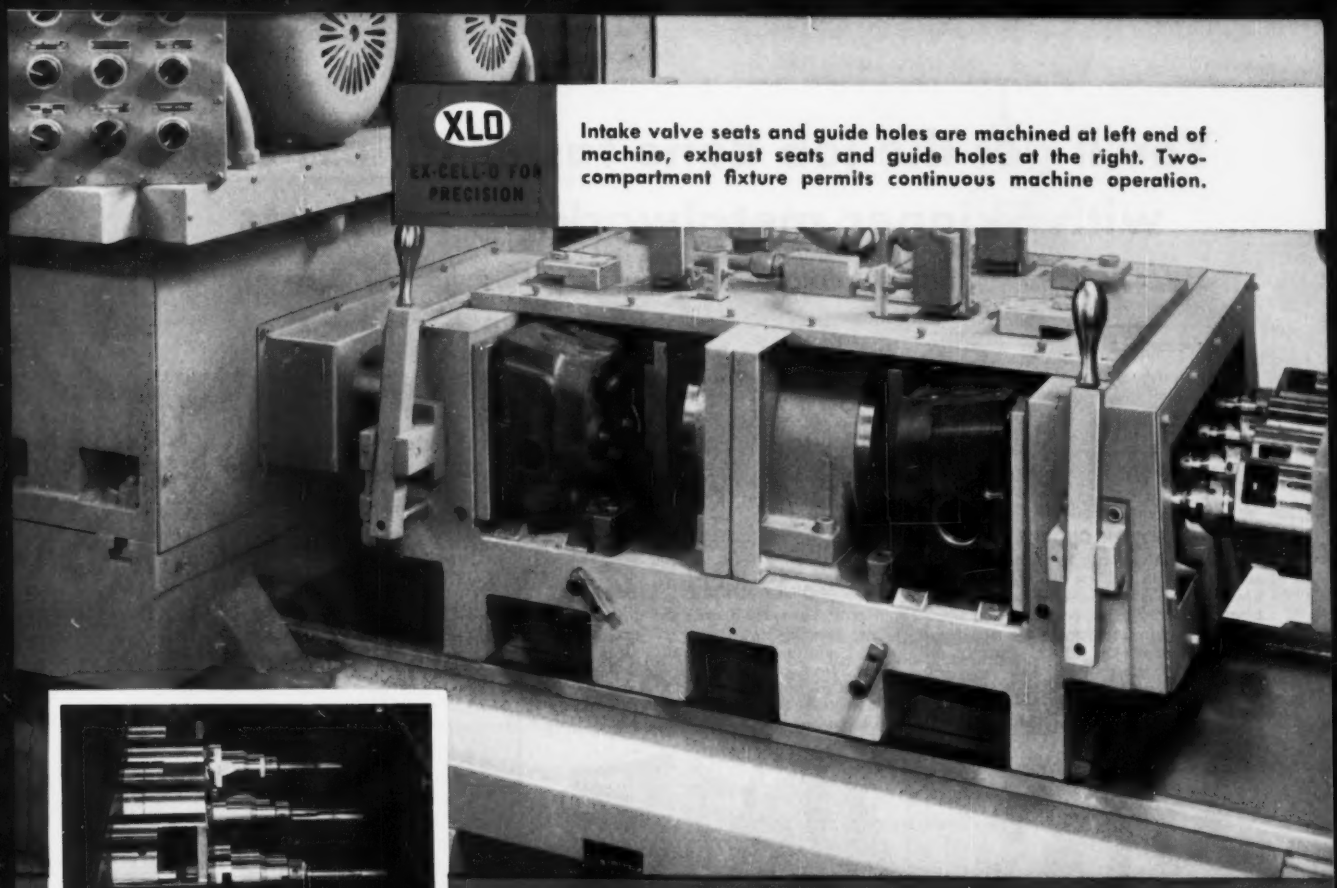
PRESS BRAKES

Steelweld engineers have had a great deal of experience in tailoring press brakes to suit special jobs. Brakes have been built with many types of beds, with various shut heights, different speeds, unusual control arrangements, special gauges and safety devices, unique feeding equipment, etc. Because Steelweld's design is such as to make changes comparatively easy, the cost is reasonable.

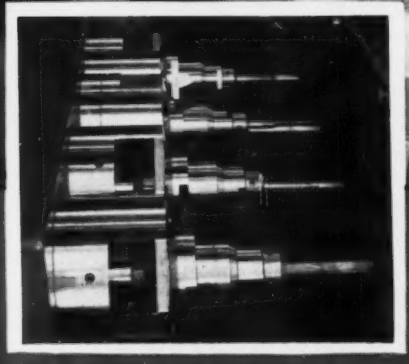
For that next metal-forming job, whether it be a standard press brake operation or an out-of-the-ordinary one, it will pay you to investigate the possibilities of versatile Steelweld Press Brakes.

Write for free copy of Catalog No. 2010

STEELWELD DIVISION • THE CLEVELAND CRANE & ENGINEERING CO. • 5465 E. 281 ST. • WICKLIFFE, OHIO



Intake valve seats and guide holes are machined at left end of machine, exhaust seats and guide holes at the right. Two-compartment fixture permits continuous machine operation.



Gun-type drills extend through spindle centers and retract automatically.

CONCENTRICITY GUARANTEED

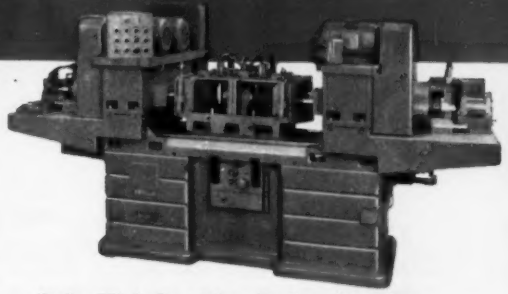
58-10

Bor-Drils valve guide holes and plunge-faces valve seats in one operation

A Standard Ex-Cell-O 17-A Precision Boring Machine, equipped for the Bor-Dril process, is turning out 23 cylinder heads per hour for a large auto manufacturer.

The table rapid-traverse feeds cylinder heads to the left into four cutters that plunge-face intake valve seats, then retract .020". Next, four gun-type drills advance through the spindle shafts to Bor-Dril guide holes from the solid—with guaranteed concentricity. The table then moves to the right, repeating the process on exhaust valve seats and guide holes.

Find out how the Bor-Dril process can help speed production in your plant; contact your local Ex-Cell-O Representative, or write direct.



Style 17-A Precision Boring Machine equipped for Bor-Dril process drills deep holes from the solid with guaranteed accuracy.

EX-CELL-O
CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

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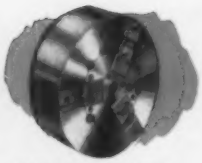
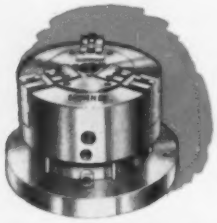
You'll get the job done faster at less cost with Skinner metalworking products

A complete line of hand chucks, power chucks, cylinders, vises



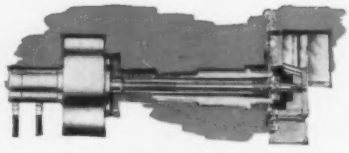
POWER CHUCKS

Provide positive gripping power. Assure accuracy within .001″ on diameter on repetitive work. Available in self-centering, combination, serrated jaw, compensating, lightweight self-centering types and in sizes from 6″ to 24″ diameter. Mount directly on American Standard Type A-1, A-2, B-1 and B-2 flanged spindle noses.



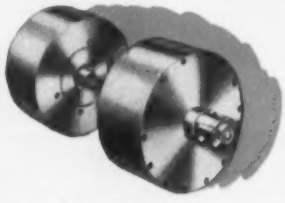
POWER CHUCK FIXTURES

Non-rotating. Hold work for drilling, milling, assembly operations. Air-operated for fast, effortless loading and unloading. In sizes from 5″ to 24″ with either two or three adjustable or non-adjustable jaws.



JUNIOR POWER CHUCKING UNIT

Designed to convert small lathes to high production power units. Case histories show users make worthwhile savings. Complete unit includes double-acting air cylinder, adapters, regulator, valve and self-centering chuck with 1/4″ to 6″ capacity. Components may be purchased separately.



AIR CYLINDERS

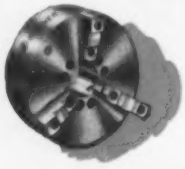
Double-acting, rotating operation. Speed production by opening or closing power chuck jaws almost instantly. Large ports assure fast action with minimum air expenditure. Standard sizes range from 4-1/2″ to 20″. Speeds up to 3500 RPM.

POWER CHUCKING ACCESSORIES

A complete line of power chucking accessories is available: Hand and foot operated valves, draw bars and tubes, air filters, complete air units.

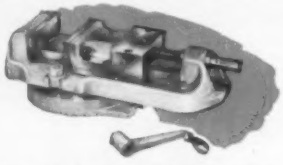
+GF+ WORK DRIVERS

Fastest, surest way to drive 1/4″ to 8-1/16″ rough or smooth blanks between centers. Used instead of driving dogs. Mount on spindle of any lathe by means of adaptor plate. Engage and disengage workpieces quickly. Positively will not loosen. Have no protruding parts. Hood completely covers jaws. Drivers will work in either direction.



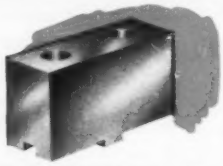
HAND-OPERATED CHUCKS

A large selection of Independent, Self-Centering and Combination chucks. Sizes suited to machines ranging from bench lathes to engine and turret lathes in sizes up to 36″. Both direct mounting types and types for use with intermediate adaptor plates.



FULL CAPACITY TROUGH VISES SERIES F AND FS

A complete line of big capacity vises from 4″ to 8″. Available with or without swivel base. Opening capacity is equal to full width of jaws. Tremendous holding power for rough or finished work. Built-in trough returns coolant to machine table.



SOFT BLANK TOP JAWS

A complete line of medium and heavy duty blank jaws accurately machined to American Standard jaw dimensions. Jaws are low carbon alloy steel which can be carburized and heat-treated to the required hardness—available tongue and groove and serrated jaw types.

Skinner Products are sold through leading Industrial Distributors and Machine Tool Builders and Dealers.

SKINNER CHUCKS®

THE CREST OF QUALITY

SKINNERCHUCKS

ESTABLISHED 1887, NEW BRITAIN, CONNECTICUT

- '59 Machine Tool Outlook
- Two-Tone GNP Scoring
- Services Order Single Custodian
- Machinery Census Seeks Data
- Washington Briefs

Keeping up with Washington

Loring F. Overman

AS THE FIRST QUARTER of 1959 nears to a close it should be possible to evaluate the accuracy of the Business and Defense Services Administration's estimate of the machine tool outlook for 1959. At the turn of the year, BDSA considered the outlook "somewhat encouraging when compared to 1958." This estimate was that shipments of metal-cutting type machine tools for 1959 would approximate $420,000,000 and shipments of metal-forming type machine tools would be approximately $155,000,000.

BDSA estimators point out, however, that forecasting for the industry presents unusual problems and that the direction of orders can change abruptly. They stated that during recent years there has been no consistent correlation between the activities of the industry and the Federal Reserve Board, and other industrial indices.

Federal Government purchase of machine tools in fiscal year 1959 may not exceed $41,000,000. It is understood that $10,000,000 has been assigned to each of the military departments. Additional funds may be made available if needs can be justified.

A stepped-up program of disposing of government-owned machine tools is likely. During 1958, changing patterns of defense resulted in some 11,000 machine tools and related production equipment items becoming excess to Government needs. During this year, between 20,000 and 25,000 items in the government inventory of production equipment will be declared surplus. The Machine Tools for Schools Program is one of several being developed to minimize the impact of the surplus disposal program on the machine tool industry. This procedure will not only strengthen the mobilization base of the country, but will also provide the fullest and most effective utilization of surplus machine tools.

Two-Tone GNP Scoring

Washington is apparently losing its faith in dollar-value as a gage of production accomplishment. In the future the Gross National Product will be reported in two ways—in terms of both current and 1957 dollars. In the past the report has reflected changes at current prices, and as a result the dollar value of GNP has been rising faster than the actual volume of production. The new system of reporting will reflect the effects of inflation.

Services Order Single Custodian

By changing "may" to "shall" in Section 202 of Appendix B, Armed Services Regulation, the Defense Department has made an optional provision mandatory. This section, involving the administration of government-owned production equipment, requires that a single Military Service Property Administrator be assigned to receive reports and information on government-owned tools used at plants having contracts with more than one Service branch and using tools obtained from them.

The new system is expected to end duplicate and sometimes triplicate reporting by contractors using government-owned production and research equipment. It should also lessen congressional criticism of Service bookkeeping by permitting more accurate control of inventories. This, in turn, should permit a more accurate interchange on Service needs and make available equipment for required purposes.

Machinery Census Seeks Data

Machinery manufacturers are being asked to provide information through the 1959 Census of Manufactures that will cover 1958 operations. This census, conducted at intervals by the United States Department of Commerce, will provide information not available since 1955, when a similar census was taken of 1954 business.

Reports within thirty days from the receipt of questionnaires are requested of the following machinery classifications: MC-35Z2, general industrial machinery and parts (except electrical); MC-35D, construction, mining, and similar machinery and equipment; MC-35F, metalworking and woodworking machinery and equipment; MC-35L, industrial machinery; MC-35W, selected machinery parts and machine-shop products; MC-35Z, primary metal products; MC-33X, industrial patterns and molds; MC-33C, foundry products; MC-33G, iron and steel forgings; and MC-33J, cold-finished steel shapes, metal powders, non-ferrous forgings, and treatment of metals.

Washington Briefs

Billion dollar expansion program for 1959—on top of $1,200,000,000 outlays for construction and equipment in 1958—is contemplated by the steel industry. Estimate is from the American Iron and Steel Institute. Expansion in 1958 increased annual capacity to 147,500,000 tons—more than twice that of any other nation.

The New Welfare and Pension Plan Disclosures Act requires that within ninety days of January 1, 1959, details of all pension plans except those covering not more than twenty-five employes must be reported to the Department of Labor. Penalties of up to $50 per day are provided for failure to report. Forms are available from Labor Department offices.

Production equipment people may find encouragement in the President's suggestion that Congress "prepare appropriate proposals for revising, at the proper time, our tax structure to remove inequities and to enhance incentives for all Americans to work, save, and to invest." Machine tool groups are urging a revision of depreciation standards to stimulate industrial modernization.

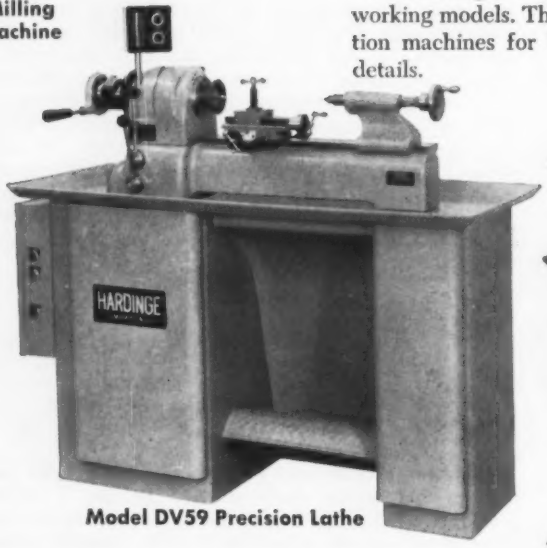
HARDINGE
ELMIRA, N.Y.

Model UM Universal Milling Machine

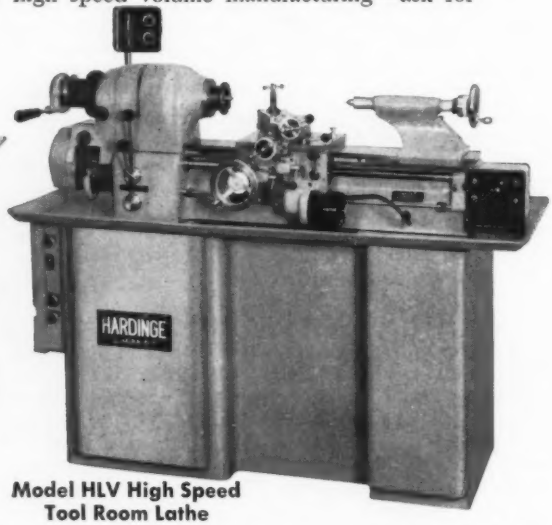
RESEARCH WORK
Demands
THE BEST IN MACHINE TOOLS

HARDINGE is the only manufacturer of companion precision machines for milling, straight turning, taper turning, boring, threading and facing with the feature of interchangeable collets, nose fixtures and attachments.

The Hardinge machines illustrated produce precision parts for working models. There are also three Hardinge precision production machines for high speed volume manufacturing—ask for details.



Model DV59 Precision Lathe



Model HLV High Speed Tool Room Lathe

SPECIFICATIONS: *The UM Universal Milling Machine has cutter spindle and spiral dividing head collet capacity of 1-1/16" and a 25 x 6-1/2" swivel table. The DV59 Precision Lathe has 1-1/16" capacity and 9" swing with 17" between centers distance. The HLV Tool Room Lathe has 1-1/16" capacity and 11" swing with 18" between centers distance.*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

Machinery
MARCH 1959

Missiles Are Not Everything!

THERE IS REAL DANGER that in the excitement about the development of missiles and the race for supremacy in space, the importance of keeping this country in the forefront industrially may be overlooked. Should Russia succeed in outstripping the United States productionwise during the next decade, as predicted by Khrushchev, the situation could be serious indeed. That this prediction cannot be discounted as an idle boast becomes evident when we realize that Russian industries do have one distinct advantage over American concerns.

That advantage stems from the fact that Russia, having started practically from scratch as an industrial nation, has its factories outfitted almost completely with new manufacturing equipment. Future expansion will be based on the most modern machinery.

On the other hand, a great number of American factories are knee-deep in obsolete and semi-obsolete machinery. Automobile and aircraft plants in general operate with modern equipment but the plants of other industries less prosperous or not government-subsidized have countless machines over twenty years old.

This is a serious plight because of the burden that existing tax laws place on the financing of new equipment. The Bureau of Internal Revenue allows depreciation to be charged only on the purchase price of equipment and it must be charged over too long a period of years. More important, however, the effects of inflation on replacement costs are completely ignored.

Most machinery costs approximately three times what it did in 1940. This means that a machine tool which cost $100,000 that year would be priced at $300,000 today. Where must the extra $200,000 come from when a machine is to be replaced?

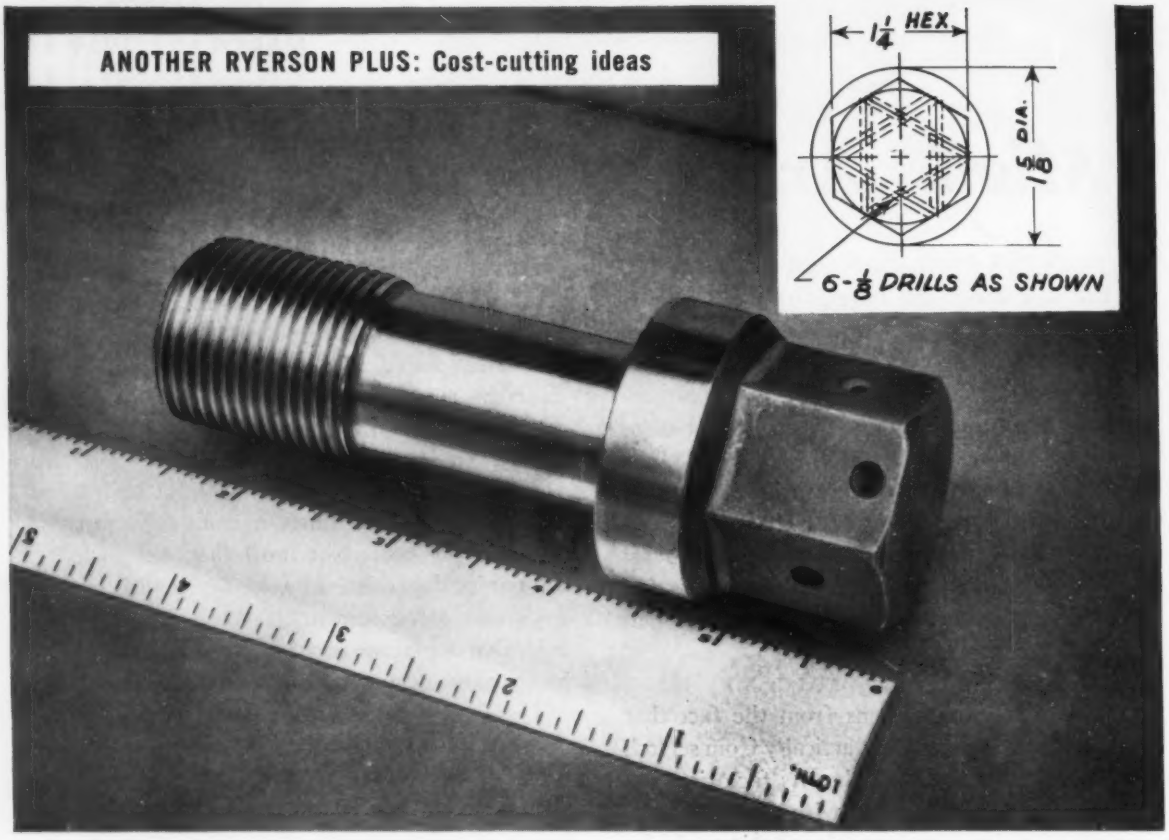
To buy replacement equipment for such a machine out of earnings, a company must make 52 per cent. Not until then can such companies depreciate in accordance with today's cost of equipment. If a concern plans extensive replacement of aged machines, it has to earn many extra millions of dollars.

Under such unrealistic tax regulations how is our nation going to expand industrially to keep pace with the Soviet countries? We must not be deluded by our apparently large annual expenditures for new plants and equipment. In 1956, for example, this figure was $39,200,000,000. Ninety per cent of this amount was for replacement, not expansion. Ten per cent expansion of production will not enable us to keep ahead of the Red countries at the rate they are going.

Hitler proved how effective adequate depreciation allowances could be in stepping up productive efficiency before and during World War II. By adopting more realistic depreciation allowances, the Government could do much to increase our productive efficiency and thereby help to insure continued economic supremacy for this country. Unlike the vastly expensive defense program, more rapid depreciation would cost the Government nothing because, in the end, the same amount of taxes would be collected.

Charles O. Herb

EDITOR



Rycut 40 drills cleanly, cuts down on tool wear and breakage.

Rycut 40 alloy steel boosts production 30%, tool life 50%

Drilling piston pin bolt heads of AISI 4140 was a costly problem at Hyland Machine Co., Dayton, Ohio.

The job called for cross-drilling two holes in each face of the hex head (see diagram). A Ryerson specialist recommended new Rycut 40, the world's fastest machining alloy steel in its carbon range.

Here are the results, from Partner Forest Hyland: "We have cut down drill breakage. We have 15% fewer rejections. There is a marked improvement in finish, plus a comparable saving shown in milling the head of the bolt. Tool life on the automatic screw machines is 50% longer, total production is up 30%. Now we can produce this bolt at a competitive price."

There is a dependable, cost-cutting steel at Ryerson to meet every requirement. The Ryerson quality controls assure you of getting steel you can count on for dependable performance—every time. Ask your Ryerson specialist for help on your steel problems.

Six-spindle automatic screw machine producing piston pin bolts with cost-cutting Rycut 40.

RYERSON CERTIFIED QUALITY

RYERSON STEEL

Member of the INLAND Steel Family

Principal Products: Carbon, alloy and stainless steel—bars, structurals, plates, sheets, tubing—aluminum, industrial plastics, metalworking machinery, etc.

JOSEPH T. RYERSON & SON, INC. PLANTS AT: NEW YORK · BOSTON · WALLINGFORD, CONN. · PHILADELPHIA · CHARLOTTE · CINCINNATI · CLEVELAND DETROIT · PITTSBURGH · BUFFALO · INDIANAPOLIS · CHICAGO · MILWAUKEE · ST. LOUIS · LOS ANGELES · SAN FRANCISCO · SPOKANE · SEATTLE

HIGH-SPEED WELDING OF REFRIGERATOR CONDENSERS

Work-holding tables arranged as a continuous conveyor carry the condenser assemblies beneath the welding rollers

H. C. COGAN, Vice-President
National Electric Welding Machines Co.
Bay City, Mich.

CONDENSERS for household refrigerators are conventionally manufactured by several different methods. One method involves the use of two shaped stampings that are welded between raised contours. Extruded aluminum sections are applied in the fabrication of a second type of condenser. In a third design, tubes are resistance spot-welded to flat sheets. There is also a recently developed condenser which consists of a multiplicity of wires welded to serpentine-formed tubes.

One leading manufacturer of household refrigerators has now adopted another condenser design that is being produced at high manufacturing rates by the use of two special, multiple-station resistance-welding machines of the type shown in this article. This welding equipment was supplied by the National Electric Welding Machines Co., Bay City, Mich. These condensers consist primarily of a continuous tube formed as shown in Fig. 1, which is welded in semicircular pockets that have been stamped in a steel sheet. The tube is seam spot-welded by the resistance method for its full length, except at the curved ends. With this condenser design an exceptionally high efficiency of heat transfer is obtained.

After the condenser design had been consummated, the problem was to develop a means of economical production. The decision was reached that it would be desirable to provide equipment that would weld the approximately 65 feet of tubing to the sheet at the rate of about 300 condensers per hour for each machine. This would mean that a total of 19,400 feet of seam spot welding would have to be done per hour by each machine. A line of welds is made every 2 3/4

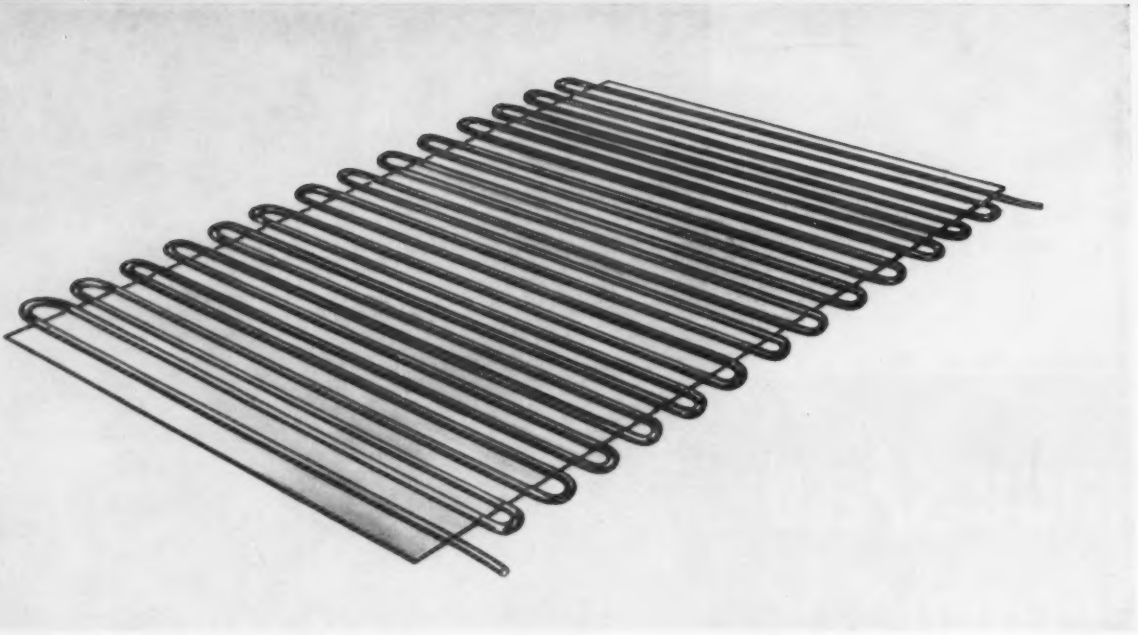


Fig. 1. Diagram of refrigerator condenser constructed of continuous tube welded in semicircular pockets of a stamped steel sheet.

inches along alternate straight lengths of the tubing. Tubing 1/4 inch in outside diameter and having a wall thickness of 0.028 inch is used, while the formed sheet ranges from 0.010 to 0.014 inch in thickness.

It was evident that equipment with multiple-station units having a maximum number of welding wheels would be required to meet this objective. Subsequently the equipment here illustrated was designed and built upon this basic idea and is now in operation. Both installed machines have a total of thirty-four seam-welding wheels and seventeen welding transformers, each transformer being rated at 70 kva. The actual speed at which the fixture-mounted work is fed under the welding wheels is approximately 15 feet per minute.

The series welding principle is used at each welding station. The welding force of each wheel is 275 pounds. The weld timing consists of one cycle "On" and seven cycles "Off." The welding head was especially designed for the pressure

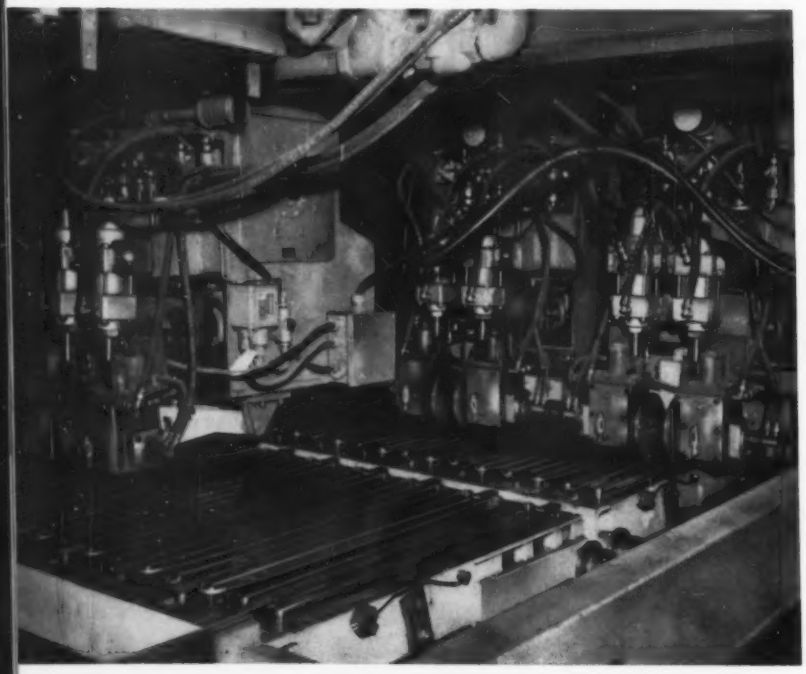


Fig. 2. Another view of the condenser welding machine showing the arrangement of the welding heads and the work-holding carriages.

mentioned, with a minimum of friction and weight. It is actuated by a bellows type air cylinder that is provided with a precision pressure adjustment.

The condenser assemblies are loaded on a multiplicity of carriages designed for the accurate loading of the work. These carriages are roller-mounted and are connected, as seen in the heading illustration and in Fig. 2, to form a continuous conveyor which is chain-driven. The carriages pass on top of the bed to carry the condenser assemblies beneath the welding rollers and return through the lower portion of the bed. There are a total of thirty-six carriages on each machine.

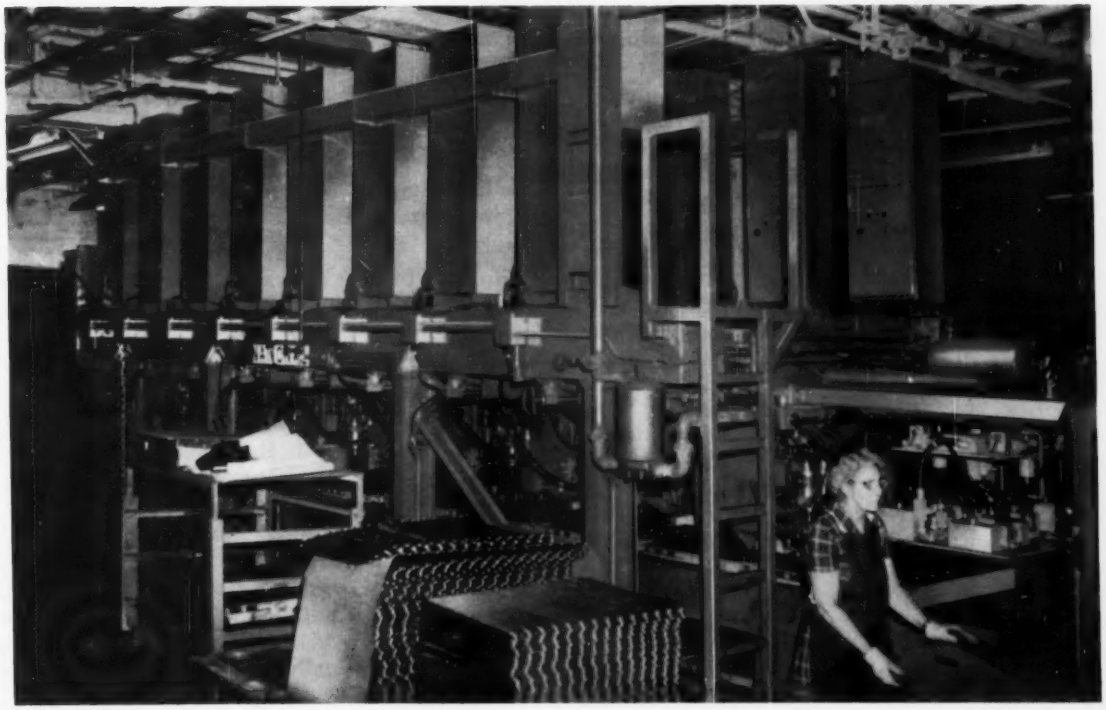
All welding stations are adjustable and can accommodate any two straight lengths of the tubing. Sixteen stations are in use at all times, and there is a seventeenth station ready to take over the work of any station where a roller change or other maintenance is required. Separate welding control panels are mounted on top of the machine for each station. The carriages are constructed of light magnesium alloy and are equipped with extruded-copper nesting dies. Cam-operated clamping fingers which can be quickly changed to suit a variety of work sizes hold the sheets in place.

In an operation, the formed tubing is located on a carriage by one operator, the equipment being designed to receive the sheet automatically from a forming machine. As the carriage travels along the machine bed, the sheet and tube are automatically clamped as the carriage nears the first welding station.

After a carriage has passed through all welding stations, a distance of some 40 feet, the clamping levers are automatically released. The welded assembly is then removed from the carriage by electromagnets (also automatically), moved to one side, and dropped onto a conveyor that transfers it to the next operation (Fig. 3). The carriage then starts on its return travel after having had its direction of movement reversed by a camming track. A duplicate arrangement at the starting end of the machine again raises the carriage to the top of the bed and starts it once more on its operating travel.

Fluid-drive couplings insure against damage to the equipment in case the travel of a carriage is impeded and safety controls are provided for each station. The equipment measures 9 feet in width by 59 feet in length by 13 feet in height. It weighs approximately 90,000 pounds. Each machine was shipped to the user's plant on a special trailer. It was necessary only to remove the top welding control panels to enable this mode of transportation.

Fig. 3. Unloading end of the refrigerator-condenser welding machine at which point the completed assemblies are removed from the equipment by electromagnets.



Ten Easy Steps to Better Tapping

JOHN F. McAULIFFE, Supervisor
Cutting Tool Research Laboratory
Pratt & Whitney Co., Inc.
West Hartford, Conn.

TAPPING is one of the most common, yet least understood, operations in machining today. Because of this fact, manufacturers often struggle with needless problems and pay high tapping costs. Many of the hardships encountered in tapping can be readily eliminated by adopting the following ten simple rules.

Rule 1. Check blueprints carefully before they reach the shop. Find out what tapping problems may exist. If it appears that there will be difficulty, consult the engineering department to see if the design of the part, material, or sequence of operations can be changed to eliminate the problem. While this approach may meet with success only a small percentage of the time, it is the surest and most economical method of eliminating needless costs and, frequently, the biggest headaches.

Rule 2. Examine the process sheets and determine the machines on which the work will be done and the fixtures that will be necessary. Order tooling well in advance of production so that operations are not started with inadequate equipment. It is best, of course, to try out all fixtures and tools before they are actually required.

Rule 3. Be specific when ordering taps. Information on the purchase order should include the following:

Size and limits of taps (1/4-28 GH-3, for example);
Number of flutes;
Style;
Type of chamfer (taper, plug, or bottoming);
Type of tooth face (hook or rake), or preferably, the material to be tapped; and
Surface treatment, if any.

A number of standard types of taps are seen in the heading illustration and one type of hook tap for an automatic nut-tapping machine is illustrated in Fig. 1.

Rule 4. Inspect taps upon receipt to be sure they conform to the purchase order, not only in quantity but in specifications.

Rule 5. Use drills of the correct size and specify frequency with which they are to be changed. Since there is little or no gain in the strength of internal threads when the thread depth is increased beyond 65 per cent of the full depth, the hole should be drilled to a size that will make the depth as close to this figure as is possible.

It is important to change drills at definite intervals to insure consistency of size and straightness of holes. In addition, dull drills will also work-harden and glaze the walls of holes in many metals, especially stainless steel, and result in short tap life.

Rule 6. Employ the recommended tapping speed. While not critical for most materials, tapping speed will affect tool life and changes in speed often produce a noticeable difference in size and finish. See Table 1 for speeds recommended for various materials.

Rule 7. Use a full flow of the proper cutting fluid if possible. On most materials and in most applications a flow of cutting oil is highly beneficial. It reduces torque, flushes the chips from the tap flutes, and helps to produce a clean thread. When a flow of cutting fluid is not available or will not remove chips, filling the hole with wax plugs or oil prior to tapping frequently solves the problem. The displacement of wax or oil as the tap enters the hole forces the chips up the flutes.

The brushing of lubricant on the taps is the least effective method of application, but does reduce torque and in most cases produces a better surface finish than by tapping dry. Recommended common types of cutting fluid or lubricant for tapping various materials are listed in Table 2.

Rule 8. To insure proper alignment when tapping, allow either the work-piece or the tap to float. It is usually safer and easier to permit the tap to float in a standard floating holder which permits radial self-alignment.

If no lead-screw is used, then an axial floating action is often desirable and is provided on most tapping heads. This allows the tap to follow its own lead and minimizes the production of oversized threads by overfeeding or underfeeding.

The use of drill chucks to drive taps is usually poor practice. This is especially true when the driving torque is fairly high. Oversized holes and burred shanks with the manufacturer's marking obliterated are generally the result.

Rule 9. Use spiral-pointed taps where possible. This is particularly helpful where stringy chips are involved, such as in the tapping of stainless steel. The spiral point directs the chips ahead of the tap and keeps the flutes clear for coolant. The three taps in the center of the standing group seen in the heading illustration are spiral-pointed.

Rule 10. Employ an adjustable torque-limiting tap driver, especially on short runs. If, however, the clutch slips frequently in spite of proper adjustment then the need for a change in tap design is indicated.

Several Prevalent Misconceptions

Taps and tapping are the subjects of many misconceptions and misguided "rules of thumb." One of the more common is that an H-3-sized tap should produce a Class 3 thread. Nothing is more misunderstood than the relationship between the H and L numbers indicating the size limits of the pitch diameter of taps and the numbers indicating the class of thread. The H number when divided by two equals the number of thousandths that the maximum pitch diameter of the tap is over basic pitch diameter. The L number when divided by two equals the number of thousandths that the minimum pitch diameter is below the basic value.

Pitch-diameter tolerances can be found in Table 331 of "Standards and Dimensions for Taps and Dies," published by the Tap and Die Division of the Metal Cutting Tool Institute. This table is also included in most manufacturers' catalogues. In sizes 1 inch and under, an L-1 tap has a pitch diameter between the basic value and basic −0.0005 inch; an H-1 tap, between basic and basic +0.0005 inch. Recommendations published by the Metal Cutting Tool Institute and others are intended as a rough guide or starting point. There is no way of accurately predicting to what size a tap will cut in various applications.

Another prevalent misconception is that blind holes should be tapped in two operations, once by machine with a plug tap and a second time by hand with a bottoming tap. The truth is that most blind holes can and should be tapped by machine in one operation. In the great majority of cases where blind holes are being tapped to

Fig. 1. Two sizes of solder type tap nibs and hook shanks used in an automatic machine for tapping precision nuts. In operation, the tap is full-floating to permit the nuts to pass over the shank.

Table 1. Guide to Proper Tapping Speeds

Material	Threads per Inch	
	Up to 14	16 and Over
	Tapping Speed, Surface Feet per Minute	
Aluminum	50-100	100-200
Aluminum Bronze	12-25	30-60
Bakelite	50-100	100-200
Brass	50-100	100-200
Bronze	50-100	100-150
Cast Iron	25-75	50-120
Cast Steel	20-30	30-50
Copper	40-80	80-150
Duralumin	50-100	100-200
Fiber	25-50	50-100
Hard Rubber	50-100	100-200
Malleable Iron	20-30	30-50
Manganese Bronze	50-75	75-150
Monel	8-15	15-20
Nickel Silver	20-30	30-60
Steel		
Mild	30-60	60-90
Manganese	15-20	20-30
Machinery	30-50	50-80
Nickel and Chromium Alloys	8-10	15-20
Stainless (Soft or solution-treated)	8-10	15-20
Tool (170-240 Brinell)	8-20	15-25
Titanium Alloys	10-20	20-30
Wrought Iron	20-50	50-70
Zinc Alloy	40-90	100-200

Notes:
1. Highest speeds should be used with lead-screw feed.
2. Deep holes require slower speeds due to chip accumulation and poor cooling.
3. Bottoming taps should be run slower than taps with longer chamfers because of the higher chip-load.
4. Taper pipe taps should be run at the slowest speeds in the range and seldom faster than 35 surface feet per minute.

the bottom by hand, the reason is either a poor setup or incorrectly engineered taps. Many times it has been found that the tap in use is a very good tap—for some other application. Often, taps of any given size are stored in one drawer or bin in the tool crib and the operator is thus left to choose the proper one from a number of miscellaneous types.

When a blind hole cannot be tapped in one operation, it should be done with roughing and finishing taps. The finishing tap has a larger pitch diameter than the roughing tap and takes a chip along the full tooth, thus reducing the chance of shaving, which might create an oversized thread.

When tapping blind holes, best results are not always obtained with spiral-fluted taps. Certain holes, mostly deep blind ones, can be more efficiently tapped with a spiral-fluted tap due to the chip-removing action of the helical flutes. The right-hand spiral used tends to lead the chips out of the holes. A spiral-fluted tap is seen at the lower left in the heading illustration.

In many cases, however, inspectors have been fooled by the apparently fine results produced in a blind hole by a spiral-fluted tap. If the part could have been dissected, it would have been seen that the finish on the flank of the thread visible from the top of the hole had been obtained at the expense of the finish on the other, more important, flank.

The idea that special taps cost more to use than standard taps is usually a mistaken one. Tapping is one of the last machining operations on most parts. For this reason it is a poor place to try to economize by experimenting with various sub-standard taps. A few scrap parts usually cost more than adequate stock of correctly engineered taps.

The only true measure of cost is the cost per tapped hole, which would include labor. Special taps nearly always result in over-all savings, since they are expressly designed to perform more effi-

Table 2. Cutting Fluids for Tapping Various Materials

Aluminum	Soluble oil, kerosene and lard oil
Bakelite	Compressed air, dry
Brass	Soluble oil, lard oil
Bronze	Soluble oil, lard oil
Cast Iron	Dry or sulphurized oil
Cast Steel	Sulphur-base oil, mineral lard oil
Copper	Soluble oil, light-base oil, lard oil
Duralumin	Soluble oil, kerosene and lard oil
Fiber	Dry
Hard Rubber	Dry
Malleable Iron	Soluble oil, sulphur-base oil, lard oil and soda
Manganese Bronze	Light-base oil, lard oil
Monel	Sulphurized oil
Nickel Silver	Sulphurized oil
Steel	
Mild	Soluble oil, sulphur-base oil
Manganese	Sulphur-base oil
Machinery	Soluble oil, sulphur-base oil
Nickel and Chromium Alloys	Sulphurized and chlorinated oils
Stainless	Sulphurized and chlorinated oils
Tool	Sulphurized oil, lard oil
Titanium	Lithopone paste and oil, sulphurized and chlorinated oil
Wrought Iron	Soluble oil, sulphurized oil
Zinc, Die-cast	Soluble oil

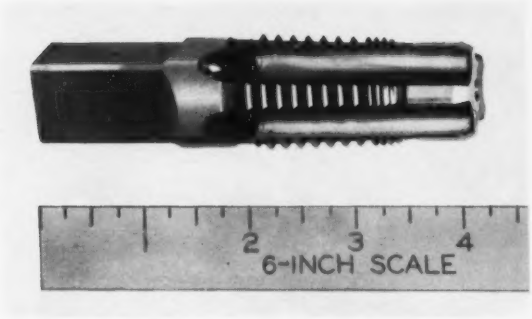


Fig. 2. Special taps are often designed to perform more than one operation. Here is a combination pipe tap and reamer.

ciently on a certain operation. In some cases, one tool is designed to do the work of several—for example: rough and finish taps in tandem, taps with pilot drill points, and other combinations. Taps for multiple operations are shown in Figs. 2 and 3.

Many times taps recommended for a specific application cost no more than those which are standard and off-the-shelf. Even a completely special tap is usually not appreciably higher in price than a standard one if ordered in reasonable quantities.

When regrinding taps, every effort should be made to copy the original geometry. Otherwise, performance will suffer. Hand grinding of chamfers will rarely produce consistent results. This practice, therefore, should be avoided.

A Few Basic Design Principles

While tap design cannot be considered in great detail here, there are several principles which are important. A good starting point for selecting the proper tap size is the manufacturer's or the Metal Cutting Tool Institute's recommendation for the size and class of thread desired. Experience in your shop and knowledge of the cutting characteristics of the material will help in determining whether to use values above or below those recommended. Generally, a tap with full eccentric pitch-diameter relief will cut larger than one with round threads. It is, therefore, advisable to reduce the pitch-diameter limit of a tap with full eccentric relief by 0.0005 inch or one H number on taps under 1/2 inch and by 0.001 inch or two H numbers on larger taps.

The chamfer angle and the number of flutes determine the average chip-load on each cutting tooth. Permissible chip-load varies inversely with the machinability of the material. The formula for determining chip-load is

$$\frac{\text{thread depth}}{\text{number of teeth chamfered} \times \text{number of flutes}}$$

or preferably,

$$\frac{\text{tan of chamfer angle} \times \text{number of starts}}{\text{number of flutes} \times \text{threads per inch}}$$

Although both formulas yield the same result, the second is preferred, since it is more accurate to measure the chamfer angle than to count the teeth in the chamfer. In steel, it is rarely practical to exceed a chip-load of 0.005 inch per tooth, with a range of 0.002 to 0.003 inch for hand and machine screw taps being normal. When the maximum chamfer length and number of flutes indicate an excessively high chip-load on each tooth, it is necessary to resort to roughing and finishing taps.

Generally, when tapping soft materials which form stringy chips more chamfer relief is required than is provided on standard taps. In addition, pitch-diameter relief is sometimes necessary in order to minimize pick-up and loading of the thread flanks. Since the permissible chip-load is also higher, shorter chamfers are often used. These require greater relief to compensate for the larger angle. In this respect, taps having high chamfer angles (bottoming taps) and those made for coarse pitches need greater chamfer relief. The commonly used methods of thread relief are illustrated in Fig. 4.

Fig. 3. This unique, dual-purpose pipe tap also effects a trepanning operation in a single setup. Specially engineered taps usually prove economical.

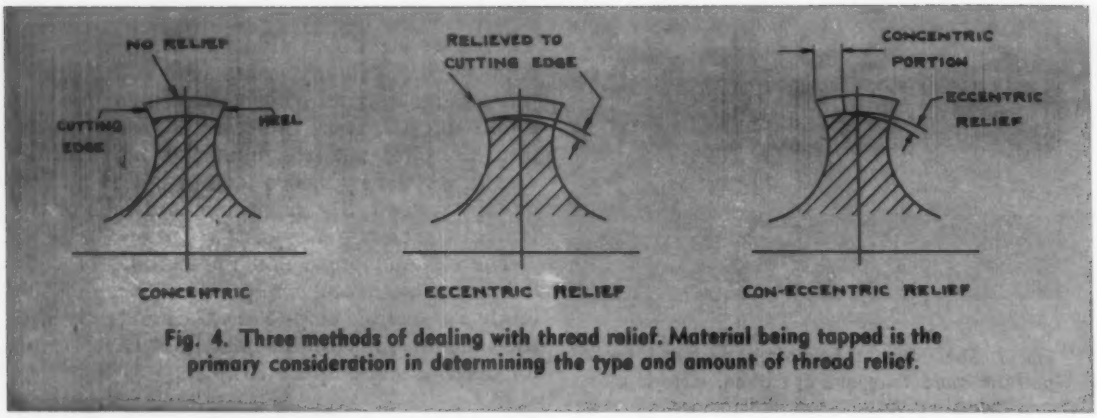


Fig. 4. Three methods of dealing with thread relief. Material being tapped is the primary consideration in determining the type and amount of thread relief.

Taps can frequently be made to perform better with the application of a surface treatment. There have been many so-called "cure-all" treatments. However, those that have stood the test of time and have been adopted by tap manufacturers fall into four classifications:

1. Nitriding, which casehardens the tap for a shallow depth to 67 to 70 Rockwell C.
2. Application of oxides, which form a film on the tap and reduce loading and friction. A few treatments also involve some stress-relieving of the tool.
3. Chrome-plating, which reduces loading, friction, and wear.
4. Vapor blasting, which reduces loading and friction.

Each manufacturer employs variations of these four types of surface treatments to secure better performance. The greatest benefit is achieved when tap life is very poor due to wear, or when loading is evident. Chromium-plating has its widest use on taps for aluminum, although other applications have been found.

• • •

Cylinder Walls Gaged Ultrasonically

For better quality control of automotive engine castings, the General Motors Process Development Staff has designed an ultrasonic gage that simplifies measuring 0.001-inch variations in cylinder wall thickness. This non-destructive tester also can be adapted to measure thickness of straight or curved surfaces of cast iron, steel, aluminum, magnesium, brass, lead, glass, and most solid plastics with only one side of the material accessible.

According to Robert B. Colten, head of the staff's electronics department, the device utilizes the principle of ultrasonic resonance. In effect, this means that a probing crystal is vibrated against the inside cylinder wall surface, sweeping as high as 4,000,000 cycles per second, until at some frequency point the surface is vibrating in harmony with the crystal. At this point the wall thickness and the crystal are in resonance. Since this resonance will vary with the wall's thickness, it can be used to give an indication of the thickness.

Cylinder wall thickness is indicated by a single, vertical step in a bright horizontal line on an oscilloscope. When the gage "decides" the wall is too thin, a red low-limit light flashes on. It is also possible to replace the warning light with other devices for automatically marking or segregating substandard parts under test.

• • •

"Brazeez" Speeds Brazing of Carbides

A "Brazeez" process developed by the National Twist Drill & Tool Co. provides a surface on carbide blanks that improves bonding. It makes brazing easier and faster and eliminates the cleaning previously required. Where induction-brazing is used, it is particularly effective, because wiping during brazing is not necessary.

A film or shell of cobalt, approximately 100 micro-inches in depth, re-surfaces the carbide blank. This is done by leaching the cobalt to the blank, thereby "wetting" its surface.

Tests and actual fabricating of a range of grades of carbide-tipped tools within the National plant have proven extremely successful. Tests in other plants are being arranged. Fabricators or carbide manufacturers who want to have samples "Brazeez"-treated for their own tests should contact the Research and Development Department, National Twist Drill & Tool Co., Rochester, Mich.

New Equipment Boosts Economy and Quality in Compressor Production

DONALD A. DETTINGER, Industrial Engineer
DeVilbiss Co., Toledo, Ohio

MODERN MACHINE TOOLS are helping the DeVilbiss Co., a leading supplier of spraying equipment, to reduce costs and improve quality in building its line of air compressors. Each compressor requires a fan-bladed flywheel pulley of cast iron.

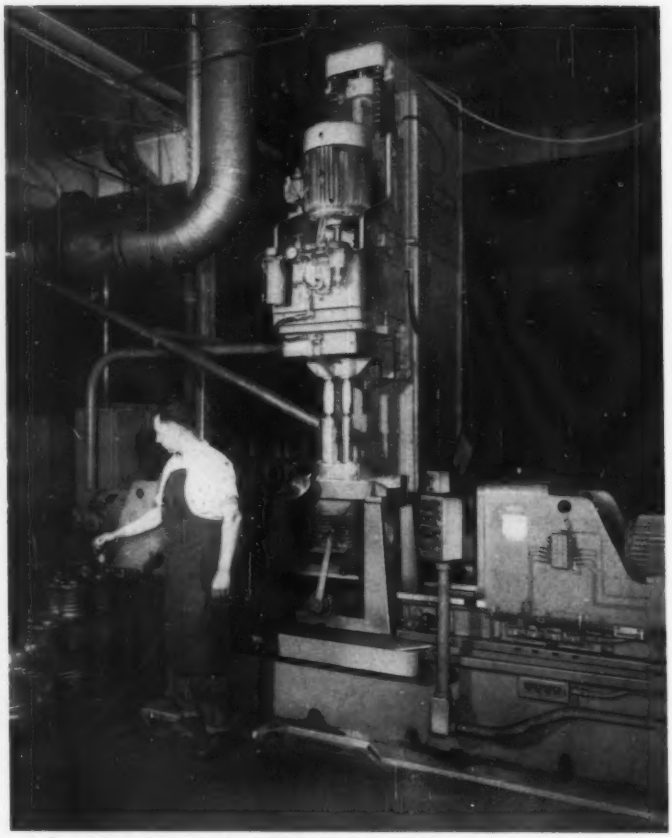
Except for the cutting of a keyway, all machining of the pulley is performed on the Potter & Johnston automatic turret lathe seen in the heading illustration. Since runs are comparatively short, the same machine is used for all pulleys from 8 to 20 inches in diameter. Operations consist of facing both sides of the rim and one side of the hub, turning the outside diameter of the rim, forming V-grooves for the belts, and taper-boring the hub.

An interesting feature of the setup is the use of the turret pilot bar to hold a cam which controls the taper of the hub bore. While the turret feeds forward, the slide tool carrying the boring cutter is forced downward by contact with the cam surface.

A Gisholt static balancing machine and a Lapointe horizontal broaching machine, also seen in the illustration, complement the turret lathe. While the latter runs through its automatic cycle, the operator broaches a keyway in the pulley hub of a completed part and balances it by drilling out excess metal at the heavy point.

Other major components of the compressors—the cylinder block and the crankcase—are produced in several sizes. In some instances, the block and crankcase are separate castings, while in other instances the two are cast integrally. Machining is done on a three-way BarnesdriL, Fig. 1. While two vertical spindles rough- or

Fig. 1. This three-way machine handles both the separately cast cylinder blocks and those cast integrally with the crankcases of the compressors.



finish-bore the cylinder, two horizontal, opposed spindles bore crankshaft bearing holes and face the crankshaft bore bosses. Tolerances held in boring the cylinders are closer than in the previous multiple setups, with the result that only a single honing is needed, as against the double honing required in the past.

In combined operations, crankshafts now have both ends faced and center-drilled on one machine and main bearings turned on another, Fig. 2. The operator faces and center-drills on the Seneca Falls lathe in the foreground, then turns the main bearings on the Bullard Hydra-Feed tracer lathe seen behind him. Both operations are automatic, only the loading and unloading being manual.

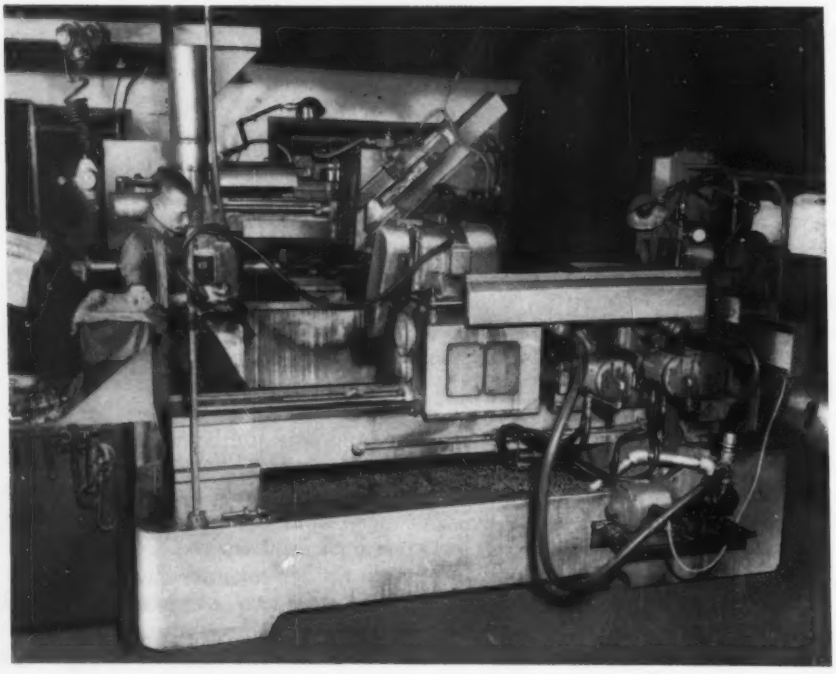
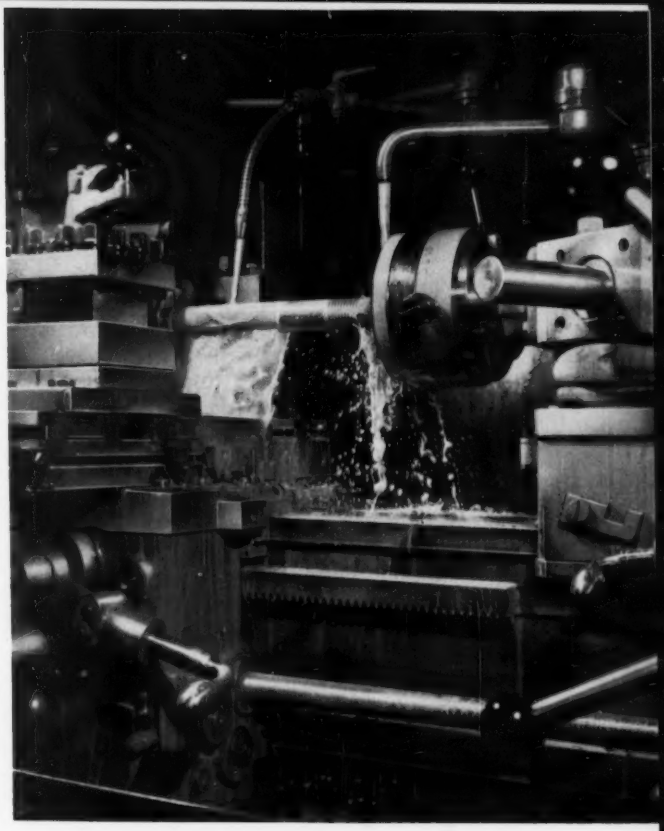


Fig. 2. The same operator faces and center-drills the crankshafts on one machine, turns the main bearings on the other.

Selection of Soluble Cutting Fluids



A discussion of modern soluble cutting coolants now available and their characteristics under different machining conditions.

SIDNEY J. BARBER, Manager
Metal Working Department
E. F. Houghton & Co.
Philadelphia, Pa.

MACHINING COOLANTS are divided into two main classes—straight oil and water-miscible. Each of these classifications can be further subdivided. For example, in the water-soluble fluids there are a considerable number of types, including the following:

1. Inactive
   (a) Emulsifiable mineral oils
   (b) Polar-active or super-fatted varieties
   (c) Detergent
2. Extreme pressure fortified
   (a) Sulphurized additive
   (b) Chlorinated additive
   (c) Combined (a) and (b)
   (d) Sulphur-fatty concentrate
3. Synthetic or chemical
   (a) Organo-amino nitrite
   (b) Nitrite-free

Straight mineral oils are excellent lubricants and their cooling power is a result of three factors, namely: viscosity, flow rate, and a specific heat of roughly 0.45. Water-base fluids offer the best opportunity for economy and provide high cooling characteristics, visibility of work, easy disposal (synthetic types), and strength of anti-weld film. Some of these properties belong only to the newer "chemi-cool" types, and not to the earlier emulsions of mineral oil.

Originally, simple mixtures of soap and mineral oil were supplied in paste form. The quality of the solubilized mineral oils reached a peak perhaps fifteen years ago. The perfection of methods for producing salt-free petroleum sulphonates of controlled molecular weight occurred at about that time.

Emulsions of straight soluble oils generally possess somewhat better properties than the mineral oils from which they are made. Their value varies with the choice of the emulsifier. Variation of straight soluble oils in which super-fatting or polar-active additions are made may be employed for a wide variety of machining operations. Usually, large amounts and special types of emulsifiers are employed. With proper selection of the diluent oil, these products serve as excellent grinding fluids.

Among the non-reactive soluble oils are included what may be called "detergent" types. This class of products has been listed as transparent, but, while they form clear emulsions when first prepared, any leakage of lubricating oil into the emulsion will cause the latter to lose its transparency. Continued leakage eventually turns the coolant into a thick molasses-like mixture that "gums up" the entire coolant system.

The machine equipment used in metal removal is often the determining or limiting factor in the choice of the coolant. Many of the newer machine tools are built specifically to take full advantage of aqueous-based coolants, but with some older types leakage problems will arise.

Often the advantages in economy, productiv-

Rating Chart for Various Types of Soluble Cutting Oils

Type	Extreme Pressure (Anti-Weld)	Tapping Efficiency	Oiliness	Emulsion Stability		Rust Inhibition		Non-Ferrous Corrosion		Over-All Rating	Recommended Concentration	
				Soft Water	Hard Water	In Solution	Residual Protection	Aluminum	Zinc and Galvanized		Machining	Grinding
Conventional Water-Soluble Petroleum Oil	45	71	75	85	67	68	86	93	85	75.7	10-20:1	...
Heavy-Duty Soluble Oil	100	100	100	97	83	81	93	98	90	93.8	25-35:1	60:1
Amino-Nitrate Solution	25	76	5	100	100	100	85	50	...	59.1	...	125:1
Partially Fortified Chemical Solution	45	81.2	32	100	100	98	83	60	...	67.7	50:1	100:1
Fully Fortified "Chemi-coolant"	85	92.6	82	98	98	100	96	85	25	84.8	50:1	100:1

Figures for the first column, "Extreme Pressure or Anti-Weld," were derived from various friction tests and modified by use experience. The heavy-duty soluble oil carried a full load on both the Almen and Falex friction testers. The laboratory tests have been corroborated by wide field experience.

Under "Tapping Efficiency," the figures are actual measurements of the torque developed. The values were obtained by tapping an average of thirty-six holes with six different taps.

In rating "Oiliness," composition, that is, the percentage of polar-active content, viscosity of the base oil, and related details, was weighted, along with wetting and penetrating characteristics of the emulsion.

Under "Emulsion Stability," ratings are given for water of normal hardness, that is, 50 to 150 parts per million and for very hard water of 450 parts per million. The values are predicated on the concentrations most frequently employed. They may vary considerably at higher or lower concentrations.

Under "Rust Inhibition," the ratings are for in-solution protection, which includes the time during which the parts are drying and the measure of residual protection afforded after the parts are dry.

"Non-Ferrous Corrosion" was evaluated by spot tests in which a solution of the coolant was allowed to dry on the surface of the metal involved, by static immersion tests, and by tests which subjected the specimen to high rotational speeds in a solution of the coolant. These values are to be used as guides only.

"Over-All Rating" is an average of each of the individual ratings. No attempt was made to weigh one factor over another and, as a consequence, factors having no bearing at all on a given application count as much as the pertinent ratings. However, with all of the requirements of a particular application being known, a job rating can be readily calculated by eliminating the ones which do not apply or by using half values for the less significant factors.

It will be noted that while the over-all rating value of the synthetic coolants appears lower than for other coolants, the dilution can be much greater.

ity, and closer work tolerances obtainable due to better cooling are sufficient to justify the use of aqueous-coolant systems despite specific design handicaps that may exist. A problem is sometimes encountered with automatic screw machines designed for use with straight cutting oil. Leakage of coolant into the lubrication system and the reverse condition, where the lubricating oil leaks into the coolant system, all too often result in an intolerable situation. In some instances, special lubrication systems have been installed on such equipment to eliminate conditions of this nature.

Detergent types of coolants contain large amounts of petroleum sulphonate combined with other emulsifiers and a small amount of mineral hydrocarbon. They are valuable as grinding coolants since they are not inclined to cause wheel-loading. Hard-water stability and rust inhibition are generally superior in these coolants to the same properties in straight soluble oils. Detergent coolants are especially suitable for milling, drilling, threading, and tapping at low speeds.

Fortified water-soluble coolants are on the market today in considerable number. They vary considerably in composition and utility, depending on the intended use and the individual supplier. Popular types are highly concentrated sulphur-fatty combinations. The better grades are treated to arrest bacterial growth.

These products represent a major advancement in coolant usage. Provided the machine tool is adequately safeguarded to separate the lubricant from the coolant, there are few operations in which maximum productivity and quality of the machine's operation cannot be obtained with a heavy-duty soluble coolant.

Synthetic or chemical coolants do not depend on emulsified oil for lubricity or upon sulphur or chlorine for load-carrying ability. To a very considerable extent they are based on raw materials resulting from nitrogen chemistry. In the earlier prototypes, comparatively simple alkanol-amines, glycol-like materials with mildly alkaline characteristics, were used. Later, complex reaction products that combined highly polar substances with the nitrogen chemicals gave stable water-soluble coolants. Additives which improve the properties of synthetic coolants include sodium nitrite, which protects work against rusting. Special organic inhibitors prevent corrosion of brass. Glycol is used in some cutting fluids to increase their lubricity. High molecular-weight lubricity additives have been developed for the newer synthetic coolants.

One salient feature of the newer chemical coolants is their small particle size, which accounts for stability of the emulsion. Disposal is simplified because of the absence of petroleum content. Sanitation is assured because there is nothing to encourage bacterial growth and no additive is required to keep them pure.

A review of the development of the Houghton line of synthetic coolants will indicate the progress that has been made in this field. First, this company marketed a grinding additive for water which inhibited against rust, but possessed no anti-weld or lubricity characteristics. A few years later film-strength properties were achieved. The present Hocut 237 possesses an unusually high degree of lubricity. The major advantages of this synthetic coolant are permanent freedom from odor, a high degree of rust inhibition, and stability in hard water. It is, however, not as good as the best petroleum-base cutting fluids for extreme pressure applications and tapping operations.

In the belief that a comparative evaluation of cutting coolants will be helpful in simplifying coolant selection, the accompanying table is presented. If full lubricity is desired, as with petroleum oils, cooling ability must be sacrificed. If low first cost is wanted stability and film strength are lost. And if maximum rust protection on steel is wanted, other metals may be attacked. Therefore, it is necessary to decide on the chief coolant characteristics desirable for a specific job, and then, the best dollar value obtainable.

Other characteristics sought in the ideal coolant—and obtainable to a greater degree than many realize—may be listed as follows:

1. Low foaming tendency.
2. Mildness comparable to that of toilet soap.
3. Properties that will not support bacterial growth.
4. Applicability to simple concentration control methods.
5. Low surface tension to reduce splash.
6. Positive wetting action (the solution must permeate into narrow work openings to reduce frictional heat).
7. Viscosity characteristics capable of absorbing shock and resisting rubbing action where low speed and large radius contact are involved.
8. Rust prevention with high dilutions and non-staining and non-corrosive action on non-ferrous metals.
9. Homogeneity—that is, all components clearly soluble with complete freedom from chemical breakdown or separation. No sticky residue or evaporation.
10. High anti-weld ability.
11. Economy, obtainable with the highest-strength coolants that permit greatest water dilution.

A great philosopher—Emerson, we believe—warned that one does not get something for nothing. Coolants, like life itself, are a compromise.

Drill Presses Dominate Production Line

JOHN H. DIEHL, General Manager
Bellefontaine, Ohio, Division
Rockwell Mfg. Co.

DRILL PRESSES bearing the Walker-Turner nameplate are built at the Bellefontaine, Ohio, plant of the Rockwell Mfg. Co. An interesting aspect of the manufacturing operation is the extensive use of the company's own drill presses for the machining of their counterparts.

The production line for the drill-head castings, for example, consists of twenty-seven machines, twenty-three of which are drill presses. Actually, it is a double line and can be tooled for nine different head models. Machines are arranged along both sides of a roller conveyor. For the 20-inch model there are five operators involved, each in charge of a work station consisting of one to four machines.

The conveyor is used for storing in-process pieces as well as for transferring a piece from one station to the next. Unlike work stations in most production lines, those in this line do not have equal work content. Most of the operators can run any of the work stations, and the line need not be filled up to function. The conveyor provides sufficient storage area at each station for a half day's work.

Some of the setups involve little more than the use of a good jig and fixturing with standard drill presses and multiple-spindle attachments. Others require special mounting of the presses to permit simultaneous drilling from two or three directions and easy handling of the work. Still others require special controls. Power feeds have been added to the presses wherever it has been practical in order to free the operator to run another machine.

In addition to ordinary operations like drilling, reaming, tapping, and spot-facing, some of the drill presses are set up for operations commonly assigned to special-purpose equipment—grinding, polishing, milling, and routing. Compact and simple, the drill presses have been easily installed in required horizontal and angular positions without complex supports or any sacrifice of stability.

Fig. 1. (Above) The castings are machined on a production line composed largely of drill presses.

Fig. 2. (Left) At this work station along the line, drill presses operate in three directions at the same time.

Trouble-Shooting Thread-Rolling Operations

BUCKLEY SULLIVAN
Consulting Production Engineer
Cleveland, Ohio

ROLLING is a popular and economical method for producing threads, knurls, serrations, and related forms in metals that can be cold-worked. The resulting parts are strong, accurate, have excellent surface finish, and can be held within narrow tolerances. As with any other process, however, problems of product quality and tool life do arise. Fortunately, in thread-rolling, most common production problems are comparatively simple to diagnose and correct.

Die wear is normally of little consequence: parts will not change dimensionally during a run unless the dies fail. It is the setup operations that are all-important. Improper setup is almost invariably the underlying cause of rolling problems so long as the work-blanks are of the proper size.

Most effects of improper setup can be observed on the rolled work-piece. A well-advised procedure on repetitive jobs is to hold aside several parts from satisfactory runs. These can be used for visual and dimensional comparison with parts from new setups for subsequent runs.

Several items should be watched for during visual inspection of rolled surfaces: rough threads having flakes or tiny slivers, poor thread form, threads not filled out evenly from end to end, scuffed crests, seams, and general thread finish. In addition, the threads must be checked for lead, pitch diameter, taper, roundness, drunkenness, and the relationship between the pitch and major diameters. Since standard inspection gages will indicate improper lead and pitch diameter, tapered threads, and an out-of-round condition, trouble-shooting can logically begin with these problems.

Lead is Either Expanded or Contracted

Lead error may be caused by improper die lead, incorrect setup, or inherent characteristics of the material being rolled. A contracted lead—the pitch is smaller than required—can usually be traced to a contracted lead on the dies.

There are two exceptions to this. The most common is due to the rolling characteristics of the work-piece material. Metal that is 20 Rockwell C or harder will spring back when die pressure is released. For such cases it is necessary to use dies or rolls having expanded leads. Dies of this type are commercially available.

The second and less frequent exception occurs when cylindrical-die machines for through-feeding are used. If the dies are set at an improper angle to the work axis the lead will be affected. Depending on whether the angle is too large or too small, the lead will be either expanded or contracted.

In the case of an expanded lead on the work-piece, the first thing to check is the die. It sometimes happens that, when hard material is occasionally run in the shop, expanded-lead dies may have been placed on the machine when they were not required. When thread-rolling attachments are used on bar machines or turret lathes, the first few threads may be extruding. A slight taper on the blank, so as to have less material at the first threads, will sometimes alleviate this condition.

Pitch Diameter Not Within Tolerance

Although a thread gage will reveal incorrect pitch diameters, it is also necessary to check the major diameter for a proper diagnosis. A condition in which the pitch diameter is large and the major diameter small can be corrected by increasing the squeeze on thread-rolling machines and two-roll geared attachments, or by increasing the penetration of single-roll attachments. The thread form, too, should be checked: a full thread on the work-piece is indicative of a shallow thread form on the dies.

When pitch diameter is oversized and the major diameter falls within limits, the most common cause is oversized blanks. Here again, a shallow die form may be at fault. However, if both pitch

and major diameters are too large, oversized blanks are the culprits in every instance.

An undersized blank will produce a threaded member that is small in both pitch and major diameters. Undersized blanks also are frequently the cause of a small pitch diameter and an intolerance major diameter, although this same effect can be produced by an excessively deep thread form on the dies. There are two possible causes for a rolled thread with an undersized pitch diameter and an oversized major diameter—too much rolling pressure or unnecessarily deep die threads.

The importance of checking the major diameter, even though the pitch diameter is found to be within limits, cannot be overstressed. An out-of-tolerance major diameter can be caused by either the blank or the dies, but whichever the case, should be investigated. Undersized major diameters indicate either undersized blanks or shallow die threads. Oversized major diameters indicate the opposite conditions—oversized blanks or deep die threads.

An undersized major diameter with the thread crests not completely filled out may be a desirable condition (assuming the pitch diameter to be satisfactory). If this quality thread form is acceptable it should be used, as it will eliminate the possibility of die overloading and thus increase die life. Where there are liable to be variations in blank diameter, non-finished crests may prove a welcome safety measure in avoiding broken or chipped dies. For these reasons many firms make it a practice not to form complete crests on rolled threads, especially when the blanks are produced by machining.

Tapered Threads

When considering tapered threads, three types should be borne in mind: one-direction tapers, tapers that converge toward the center (large at the ends), and tapers that converge toward the ends (larger at the center). A blank with a one-direction taper will normally produce a combination of straight pitch diameter, tapered major diameter, and incomplete threads on the small end of the taper. If both major and pitch diameters are tapered in the same direction, a tapered blank has been accompanied by dies improperly set to match the blank taper.

When the major and pitch diameters are tapered in opposite directions, the threads on the end having the small major diameter normally will not be completely filled out. This is caused by the dies being set at a taper—they are too far apart at the end with the oversized pitch diameter and do not exert sufficient squeeze. A condition of opposite tapers involving single-roll attachments can usually be traced to bending of the work under roll pressure.

If the thread is filled out at the ends of the work-piece but not in the center, the first thing to check for is end-to-end variations in blank diameter. On cylindrical-die machines and on thread-rolling attachments, this condition may also be caused by variations in die or roll diameter. On reciprocating type machines, it may be caused by a die face that is not perfectly flat.

In the event the blank and the dies are found to be straight, it should be determined whether or not the center line of the dies and that of the blank coincide. If the work is being through-fed, the parts should follow each other closely through the dies to prevent the ends of the stock from being over-rolled.

Rolled Work-Piece is Out-of-Round

The reason for an out-of-round work-piece is more difficult to pinpoint and correct because there is a wide range of possible causes. An obvious fault is an out-of-round blank. Another possibility is that the work material is insufficiently ductile for cold-working. Parts that have been cold-headed may require annealing if they have undergone a considerable degree of work-hardening.

When rolling attachments are being used, the feed may be set too high or the rolls may not be dwelling long enough at the end of the infeed movement. In addition, the center line of the rolls may not be set parallel to the center line of the work or, with two-roll geared units, the feed stroke may not be long enough to carry the rolls to the center line of the work.

On cylindrical-die machines, out-of-roundness can be caused by crooked feeding, by having the rate of penetration too high, or by releasing the dies too soon. Probably the most common cause of this condition on reciprocating-die machines is using dies that are too short for the job. Two other frequent causes are excessive pressure at the finish end of the dies and a poor thread form on the relief section of the stationary die.

Should the thread be full on one side of the work-piece and not on the other—as though the axis of the thread form and the axis of the blank were eccentric—it is possible that the blank received a crooked start into the dies. Poor matching of the dies when the machine was set up will produce the same result.

What Causes Drunken Threads?

Inspection gages will indicate drunken threads —threads that neither coincide with a true helix nor advance uniformly. Where a drunken thread

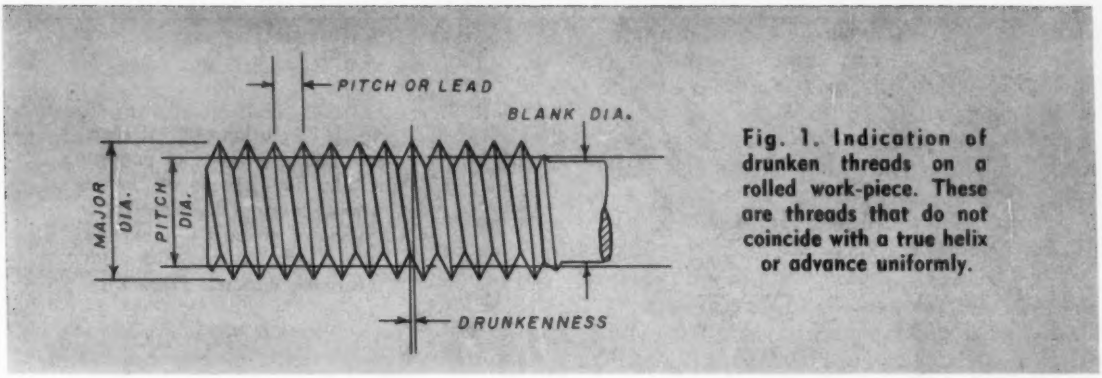


Fig. 1. Indication of drunken threads on a rolled work-piece. These are threads that do not coincide with a true helix or advance uniformly.

exists, a root on one side of the part is not directly in line with a crest on the opposite side, Fig. 1.

On thread-rolling machines and on geared two-roll attachments, drunken threads may be caused by dies or rolls that are not properly matched. With either single- or double-roll attachments the fault may be that the center lines of the rolls are not parallel to the axis of the work. The problem may also be the result of excessive feed pressure, forcing the work to bend during rolling. Finally, the fault may be traced to the accuracy of the rolls.

Another cause of drunken threads on cylindrical-die machines is crooked feeding of the blank. On flat-die machines the fault may be traced to a tipped start of the blank, crooked relief on the dies, or slipping of the blank before it passes between the dies. An improper helix angle on the dies is another, although less common, factor.

Poor Surface Finish

Non-dimensional defects such as surface finish, splits, and crests may be found by visual inspection with or without magnification. Some causes of poor surface finish can be traced to the thread-rolling machines and attachments and some can be traced to the ductility of the material being worked. Some materials such as leaded naval brass, Duronze III, nickel-aluminum bronze, extruded nickel silver, manganese bronze, and hardened beryllium copper do not roll to a good finish. A few aluminum alloys also produce a poor finish: 5052-H38, 5056-H38, and 7075-T6. (All three of these alloys will roll satisfactorily in the annealed condition.)

Some materials will yield a mediocre finish when rolled. Among the ferrous types are AISI B1111 to AISI B1113 steels together with those steels which will not take severe metal displacement as would be caused by steep thread walls or wide root flats. Of the aluminum alloys, the following fit into this finish category: 2011-T3, 2014-T, 3003-H16 and H18, 5052-H34 and H36, 6061-T6, and 7075-O. Steels that can be expected to produce a barely acceptable finish under these conditions are the leaded varieties of AISI C1117, C1141, C1213, and silicon-manganese alloys (AISI 9255 to 9262).

Non-ferrous materials that may prove troublesome--in addition to those mentioned previously --are 10 per cent phosphor bronze, leaded phosphor bronze, and free-cutting phosphor bronze. Also included are leaded nickel silver, Inconel, and Hastelloy A, B, and C.

Poor surface finish may result from filling of the rolls with dirt, scale, or flakes. Machined blanks should be thoroughly cleaned before rolling to avoid carrying foreign matter into the dies. If threads are being rolled on multiple-spindle automatic screw machines and the rolling station is beneath a cutting station, it is imperative that the work be flooded with lubricant to wash away any chips that might drop onto it. Frequently, a sheet-metal shield is the only positive way to prevent falling chips from being rolled into the work.

Dies should be checked to make certain they are matched and that they are not chipped, broken, or worn. On flat-die machines the work may be slipping at the start of the rolling operation. On the other hand, if cross-nicks have been added to prevent this slipping, they may have been cut too deep.

Flakes or slivers that have been torn loose from the blank and deposited on the surface of the threads may be traced to any one of several factors. Here again, the work material may be the cause. Metal that is seamy, laminated, or has cold shuts; or a rough finish on the blank will produce a rough, torn surface. The dies should also be checked for overfilling.

Mismatched cylindrical dies, a tipped start of a blank, or a work-rest set too low will have this same effect. A few additional items should be checked on flat-die machines: too-deep cross-nicks, improper helix angle, initial slipping of the

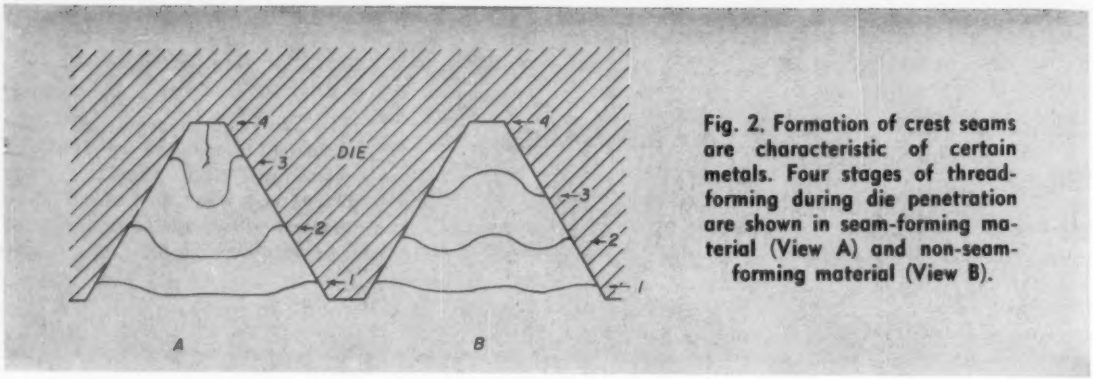


Fig. 2. Formation of crest seams are characteristic of certain metals. Four stages of thread-forming during die penetration are shown in seam-forming material (View A) and non-seam-forming material (View B).

work or, occasionally, using a machine and dies that are too large and clumsy for the job at hand. With attachments, the setup should be checked for tightness and the feed rate must not be so slow as to cause slippage between the rolls and the work at initial penetration.

Thread Form is Unsatisfactory

The most frequent cause of an unsatisfactory thread form on the work-piece is a correspondingly poor thread form on the dies. It may also be that the dies are mismatched or that the work-pieces are not being fed straight. Another cause might be that the flat-die machine being used is of a much larger capacity than required.

Except for poor thread form on the rolls, a different set of conditions can be suspected with attachments. Parallelism between the axes of the work and the rolls as well as matching of the rolls should be checked. Infeed pressure may be too great, causing the work to flex. Conversely, an insufficient feed rate will cause the metal to form too slowly. Too long a dwell period at the conclusion of the feed stroke will cause excessive rubbing between the work-piece and the rolls, leading to a distorted thread form.

Scuffed Crests, Axial Seams, and Crest Seams

Scuffed crests are not usually found on threads that have been rolled on a flat-die machine. However, this condition may be due to several factors on both cylindrical-die machines and rolling attachments. Guide tubes, if used, may not be properly aligned with the work axis when the dies have reached their full depth of penetration. Also, the work-support blade may be either too soft, too rough, or improperly located. Naturally, any foreign matter that has been allowed to accumulate in the die threads will cause what appears to be scuffed thread crests on the work-piece. Improper lubrication is another possible cause.

In the case of an axial seam—a line running axially along one side of the work-piece—the blanks should be examined to ascertain whether previous operations have left a mark on the surface. A mark of this type may have been caused by a mismatch of cold-heading dies or by the retraction of a turning tool when the blank was machined. It may also have been caused during rolling on a flat-die machine by excessive pressure, especially at the finish end of the dies; insufficient relief on the stationary die; or dies that are not long enough for the job.

Crest seams are usually peculiar to certain metals. When a crest seam is formed, the material, under pressure of the root-form section of the die, displaces only locally as shown in four successive steps at the left in Fig. 2. During penetration the metal peels back—the thread being formed by two ridges that increase in height and move closer together until the thread is completed. In most cases the seam is shallow and can be considered a surface condition.

Non-seam-forming materials are displaced in a different manner during rolling, as can be seen at the right in Fig. 2. As penetration is effected, the material humps up midway between the die threads. This hump grows at a rate that is as fast, or faster, than the die penetration, forming a solid crest as it contacts the respective portion of the die form.

Penetration rate has an effect on seam formation, apparently being the only thing about crest seams that can be adequately controlled. Flat-die machines have a normally higher penetration rate than do cylindrical-die machines and produce a lower incidence of crest seams. When the penetration rates of cylindrical-die machines are stepped up to approach those of flat-die machines, seam incidence drops off. Principally, crest seams may be expected when working with the following materials: Types 403 to 446 stainless steels, slight to medium seam; and titanium, where seams result from any blemishes or imperfections on the blank surfaces.

When External Threads Are Rolled on Hollow Work

Problems arising when working with hollow blanks are usually unique. While most of the faults mentioned previously may also apply to hollow parts, there are a few more that will not be found in conventional blanks. Flat-die machines are not commonly used for rolling hollow parts as the required work-support arbor cannot be readily fitted to them.

On cylindrical-die machines, an out-of-round condition may be the result of too rapid a penetration, too short a dwell period after the dies have closed, or too rapid an opening of the dies. In addition, the wall on the part may simply be too thin to withstand rolling pressures. If possible, the hole should be drilled after rolling.

It may possibly happen that the hole in the work-piece is reduced in diameter after rolling. In this case, a supporting mandrel is called for. Should the rate of penetration be too rapid, a decreased hole size will result. Thin walls on the part will have the same effect.

Strange as it may seem, two causes of the hole closing in may also lead to an enlargement of the hole—thin walls and fast penetration. In addition, the mandrel may be too tight. If the blank diameter is oversized, a forging action will take place between the mandrel and the die with consequent lengthening of the work circumference and enlarging of the inside diameter.

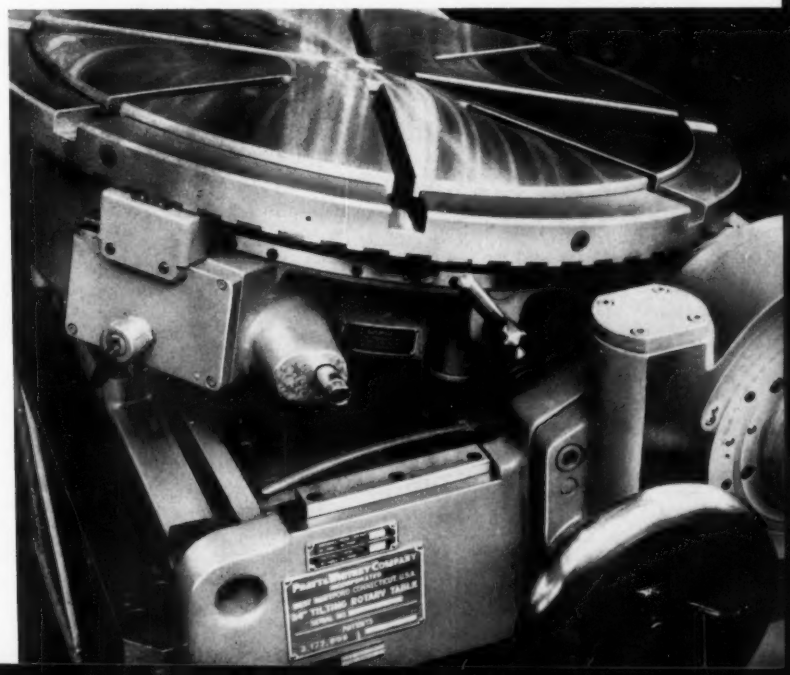
Tapered threads can be troublesome. The cause of this condition can be hard to track down and alleviate. Tapered threads on hollow work are usually caused by uneven wall thickness or uneven support. The arbor may not fit properly or give sufficient support where most needed. If the thread taper is always uniform, the dies can be designed to allow for this tendency. Feed, or penetration rate, may be too high. Wall thickness may be insufficient, in which case the bore should be finished after rolling. (This may be the only permanent cure for some part designs.)

Rotary Table Counters the Earth's Rotation

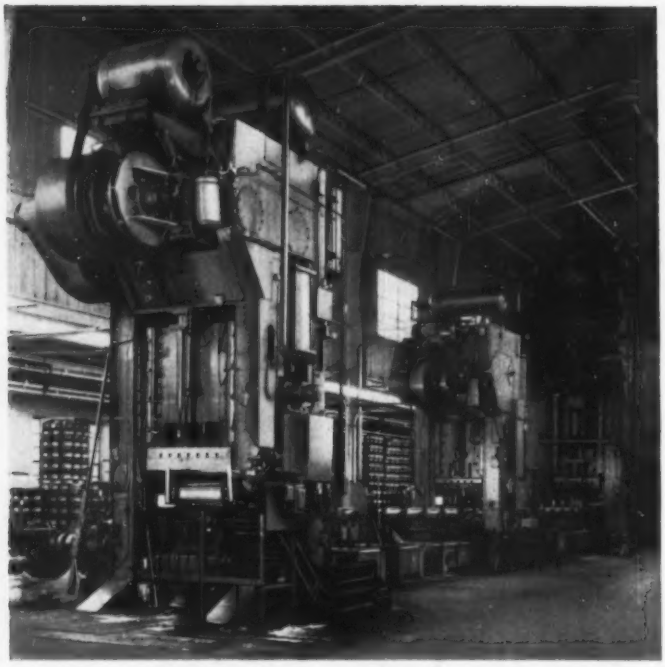
A platform not subject to the earth's rotation is required for the calibrating and testing of navigational gyroscopes, such as those used in missiles and rockets. The Pratt & Whitney Co., Inc., West Hartford, Conn., has developed a special, tilting rotary table for this purpose.

The earth rotates one revolution in twenty-three hours, fifty-six minutes, four and nine one-hundredths seconds—the sidereal day. To counteract this motion of the earth, the special rotary table is designed to revolve at an angle correlated to a selected star's path and at a rate of speed based on the sidereal day, but in the opposite direction.

Since it is necessary to establish very accurately the 5-degree intervals in the sidereal day and pass this information on to the computing equipment that calibrates the gyroscope, the table is equipped with a high-precision Electrolimit measuring system. A rim on the 24-inch table faceplate is equipped with lugs spaced 5 degrees apart. As the table rotates, a sensing head picks up the magnetic center of each lug and passes a signal to the computing equipment.



Tilting rotary table used for calibrating and testing navigational gyroscopes. Table is accurately tilted and revolved to counteract earth's rotation.



Blanking, drawing, trimming, piercing, and restriking operations on pump housings for automatic transmissions are performed by three presses without manually touching the part. Subsequent welding of the hub and close-tolerance machining are also substantially automatic.

Automation Aids Production of Automatic Transmissions

D. M. GABBERT, Master Mechanic
Borg & Beck Division, Borg-Warner Corporation
Chicago, Ill.

STEEL PUMP HOUSINGS are among the major stampings used in automatic transmissions. Although many housings are produced in plants of automobile manufacturers, a large number are also made by the Borg & Beck Division of the Borg-Warner Corporation, Chicago, Ill. Some of these are precise duplicates of stampings that are or have been produced by car manufacturers. To compete at a price that is favorable to the purchaser and yet satisfy the exacting specifications, Borg & Beck is producing the stampings in well-automated setups.

Although housings are similar, they vary in many details and different dies are used for production of the drawn shells. For example, there is no flange on one housing, but another housing has a flange on which heavy coining is required. Both parts, however, are made in the same press line and the same feeding and transfer equipment is used. The operations described in this article are those employed in producing a Buick automatic transmission pump housing.

All press operations on this housing are performed along the machine line shown in the heading illustration. The part is stamped from 3/16-by 20 3/4-inch SAE 1008-1010 steel obtained in 9000-pound coils that are placed successively in the Littell cradle and uncoiler-straightening rolls. These are arranged to feed the stock automatically to a second set of Littell rolls at one side of the first press in the line, which is at right angles to the uncoiling line. Before entering the die, the stock passes rolls that apply drawing compound.

A 600-ton Verson press having a 24-inch stroke is the first unit in the line. In this press, a circular blank is cut when the ram reaches a point 6 inches above the end of its working stroke. The blank is then drawn to a depth of 5 7/8 inches in the remainder of the stroke. Scrap is cut up, fed onto a conveyor, and deposited in a tote box.

The drawn stamping is removed from the die by an air-operated stripper and is gripped in the pick-up jaws of the first Hamilton automated transfer unit, as shown in Fig. 1. These jaws, which are mounted on a carriage, lift the stamping, move it horizontally out of the die, lower and release it onto shuttle bars, and then return horizontally to pick up the next stamping.

On being removed from the die, the stamping trips a switch which permits the press to make the next working stroke. This safety measure prevents the die from closing until the prior piece and jaws are clear of the die. The stampings are advanced a fixed distance at each cycle of the transfer shuttle. At the final station, carriage jaws pick up the piece and load it into the die of the next press for trimming and piercing.

Length of the first automated transfer unit is 38 feet. This is longer than necessary for current production but allows space for additional equipment to perform intermediate operations should any be required for specification changes or for production of another part. In loading the second press, the stamping is first advanced to a position above the die and then lowered into the die and released. The transfer jaws retract clear of the die before picking up the next housing.

Precise location of the work-piece in the trim die, Fig. 2, is assured by three pins with tapered ends. This die is in a 200-ton Verson press, also having a 24-inch stroke. Besides trimming the flange to its final contour, the die pierces a central hole in the domed top. As the die opens, grippers on the unloading carriage of a second Hamilton transfer unit lift the piece and transfer it to shuttle bars for advance to the third press. An air-operated device moves the metal cut away in the trim die onto a conveyor that discharges into a tote box, clearing the die for the next press stroke.

A die in a 1500-ton Verson press, the third and largest unit in the line, is used to restrike the stamping for precise sizing, to coin the flange, and to form two steps surrounding the central hole to correct height. The ram of the press has a hydraulic device that protects the press against breakage in case of excessive overload. This device is set at 1700 tons, which is close to the actual maximum load applied. As the periphery of the flange is confined, the restrike blow forces metal inward, producing a smaller radius where the housing wall joins the flange.

Loading and unloading of the restrike die are accomplished by automatic transfer units similar to those used for the second die. A final Hamilton transfer unit advances the housing to the end of the press line. Thus, the stamping is produced in a line of three presses without being touched by hand. All of these presses are operated at twelve strokes per minute.

If machine tools are operating in step with the press line, the stampings are fed directly through a washer and onto a conveyor supplying these machines. Otherwise, washing is delayed, the parts being shunted out of the line and stacked by hand on pallets. Drawing compound remain-

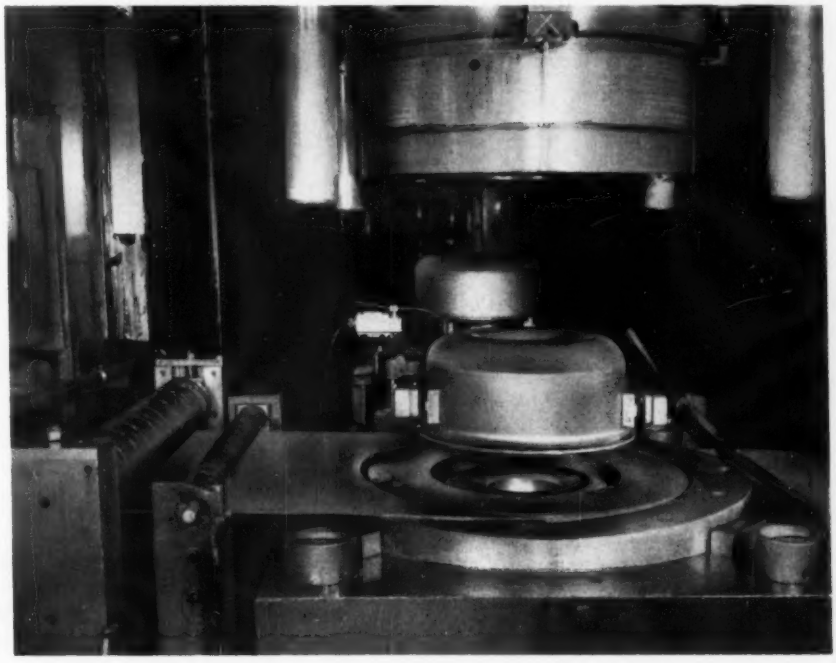


Fig. 1. While drawn piece is removed from press by carriage jaws of the first transfer unit, previous piece is elevated and rested on shuttle bars for advance to the next press. Stock is fed between rolls (left) that apply drawing compound.

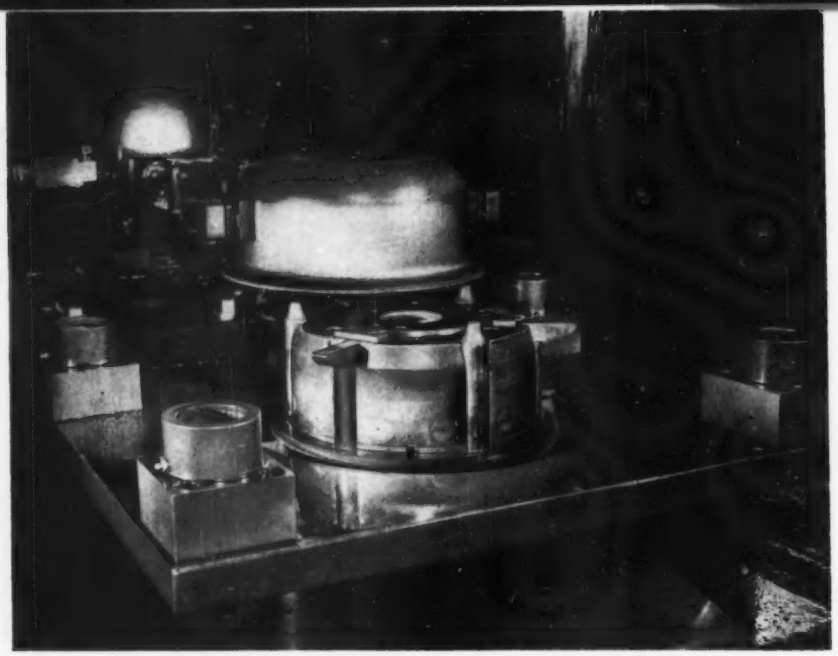


Fig. 2. Pump housing as it appears after being lifted from the second die which trims the flange and pierces the large central hole. Three pins around circumference of die have tapered ends to help locate each piece during automatic loading.

ing on the stampings helps to prevent them from rusting while in temporary storage.

In producing the stampings, dimensions must be held closer than those commonly specified for drawn parts because of several subsequent internal and external machining operations. If the stampings are not to specified size, they will not "clean up" properly in machining.

After the final stamping operation, a rough-machined, flanged hub of SAE 1062 steel is arc-welded into the large hole already pierced in the center of the housing. Both parts are washed and dried before welding.

Although the hub has a rather high carbon content, excellent welds are produced without any preheating. Welds must be leakproof, but since almost no leaks have been found in early production, leak testing is delayed until subsequent machining has been completed.

Welding is done on a Progressive machine equipped with an indexing table. Hand loading of the machine takes place at the front station. After the housing has been set, flange down, in a simple fixture, the hub is inserted by the operator. The flange is made a free fit in the hole to help the escape of gas produced in welding.

When the two parts are in place and have been indexed to welding position, Fig. 3, the Lincolnweld head at this station is lowered and granular flux is allowed to flow and submerge the weld. Rotation of the work-piece starts the instant that the 1/8-inch wire electrode is fed down to contact the work. To help keep the head at the proper level, rollers held in yokes press down against the dome of the stamping as it rotates.

Only eighteen seconds are required to load the two parts, weld them, unload the weldment by hand, and dump the flux into a hopper below the table. Unfused flux is re-used. During the welding

Fig. 3. Indexing machine with welding head for automatically making a submerged arc weld that joins the flange of the steel hub to the top of the housing. Neither part is preheated.

Fig. 4. In this four-station indexing machine, the thrust face of the hub is hardened, the work being heated by induction and quenched by a coolant. The thrust face is rough- and finish-ground in the following two stations.

operation, an 800-ampere, constant-voltage rectifier provides a 27-volt potential that produces a flow of 300 amperes to the arc. Except for loading and unloading, the welding is automatic.

Following this operation, the weldments are hung on an overhead chain conveyor and advanced to one of two Bullard eight-spindle vertical chucking machines for facing, boring, and counterboring of the hub. In addition, a portion of the internal surface adjacent to the flange of the stamping is bored, and both sides of the flange are faced. At the final station of the vertical chucking machines, a geared head drills sixteen flange holes simultaneously.

After drilling, the housings are transferred to a four-station Hoern & Dilts indexing machine, Fig. 4, where they are hand loaded, one at a time, into a pot chuck at the front station. Then, the work-piece is indexed to the next station where a 50-kva Tocco induction heater raises the internal thrust face of the hub to quench temperature. A mixture of Cimcool and water is then applied. Quenching produces a minimum hardness of 60 Rockwell C. The coolant is filtered and re-used.

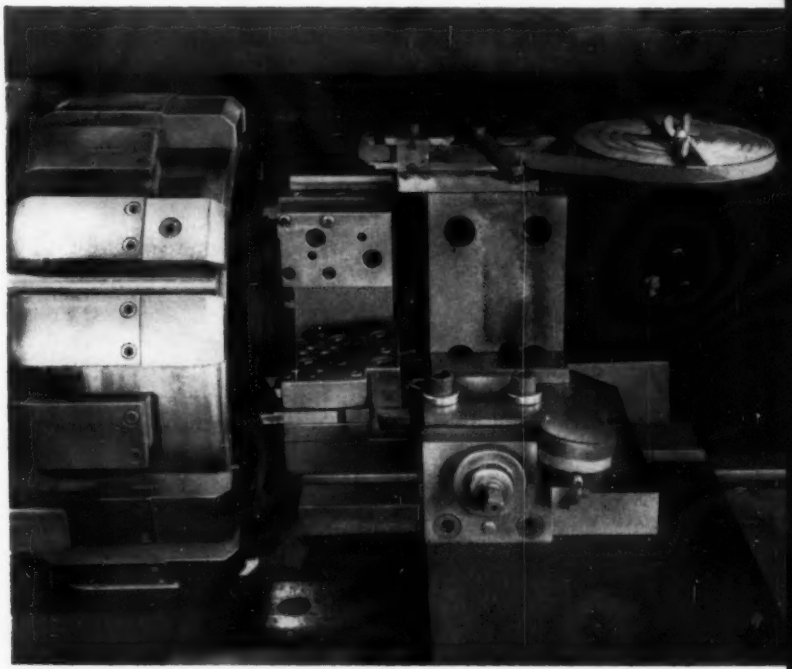


Fig. 5. Here, boring and facing are performed in an automatic lathe on a blade assembly that has been welded to the interior of the housing. In addition, emery-coated tape is held against the flange to remove burrs left in a prior drilling operation.

A wheel on a vertical spindle is lowered to rough-grind the hardened face at the third station and finish-grinding is accomplished by a second wheel at the fourth station. On return to the first station, the completed piece is unloaded by hand and a new piece is loaded. All other operations on this machine are automatic. Cycle time per piece is about twenty-five seconds, with 700 pieces processed per eight-hour shift.

Each housing is leak-tested at this stage of production, but as the welding quality is high, rejections seldom exceed four per day. After washing, an impeller-blade assembly is spot-welded inside the housing at eight points and hand Heliarc welds are made around a large-diameter shoulder. Then, the work-piece is chucked in a Sundstrand automatic lathe, Fig. 5, where the blade assembly is precision bored and faced.

An unusual feature of this setup is the application of a coil of emery paper strip mounted in back of the tool-holder. This strip passes over a rig and deburrs the holes drilled in the flange. A hand lever is moved occasionally to advance the abrasive strip as the emery wears off.

The gear-mounting surface and a portion of the hub are then turned on a Gisholt automatic production lathe. The work-piece is further processed in another four-station Hoern & Dilts indexing machine which operates on a twenty-seven-second cycle. In the station seen at the left in Fig. 6, the hub is semifinish-turned and faced. A milling cutter produces tangs on the end of the hub at the fourth station. Following this operation, the parts are loaded at the first station of a third Hoern & Dilts four-station indexing machine. Progressive induction hardening of the outer periphery of the hub to a minimum of 60 Rockwell C is accomplished at the second station. Heat is applied by the 50-kva Tocco generator used for the previous hardening, the unit being employed alternately for the heating operations.

The periphery of the hub is rough-ground at the third station and finish-ground at the fourth station, holding a total tolerance of 0.0006 inch. Size is controlled automatically by a Pratt & Whitney air limit gage. This gage is arranged to stop the wheel when the hub diameter is the specified size. Grinding results in a 15-micro-inch finish.

In this operation, a fine-grain cupped wheel is set at a 45-degree angle to bring the face vertical to the surface being ground. A diamond dresses the wheel before each cut. As in the other induction-hardening setup, a water solution of Cimcool is used both as the quenching medium and as the grinding coolant. This mixture is filtered before recirculating. Its temperature is controlled.

In a subsequent operation on a Monarch lathe, the outer face of the hub flange is finished by a titanium-carbide tool cutting at 1000 fpm (feet per minute). A ceramic tool finishes the edge of the weld. Both tools are of the throw-away type. The titanium carbide makes thirty-five to fifty cuts per point, and the ceramic tool, about 150 cuts. A 30-micro-inch finish is obtained by both.

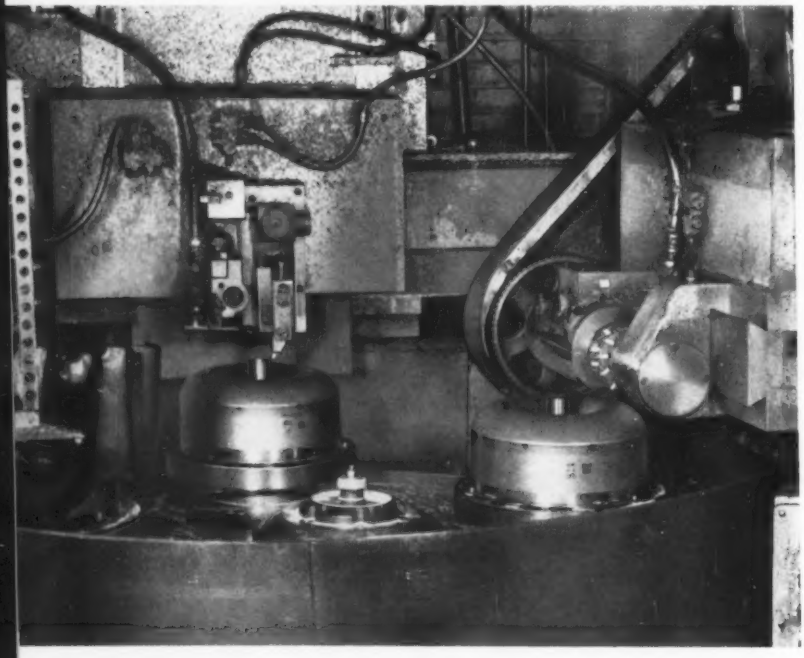
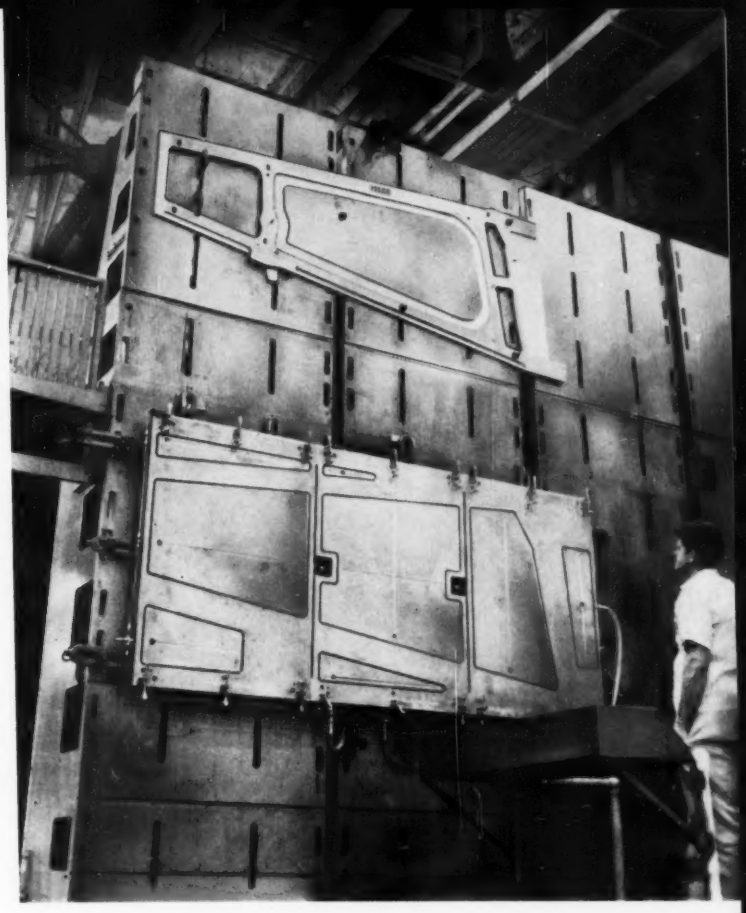


Fig. 6. At the left, the hub is semifinish-turned and faced in a second indexing machine. In the final station (right), tangs are milled on the end of the hub.

Jetliner Parts Held by Vacuum for Machining

H. B. PAWASARAT
Machine Tool Supervisor
and
M. B. NEWBERGER
Senior Tool Design Engineer
Douglas Aircraft Co., Inc.
Long Beach, Calif.



THE USE of vacuum techniques to clamp parts for machining has been enlarged in scope at the Long Beach, Calif., division of Douglas Aircraft as a result of that company's DC-8 Jetliner program. For holding thin work-pieces, either flat or contoured, vacuum clamping has generally proved superior to purely mechanical means.

Before a fixture can be designed for vacuum clamping, a number of factors must be considered. To begin with, the part must have a large, smooth surface to which the vacuum can be applied and held while the cut is being made. A large part is more likely to reflect a cost saving than a small one—particularly a part that would ordinarily require more than ten or twelve simple mechanical clamps. Vacuum clamping can also be justified, even though the fixturing is more expensive, if the rigidity of the part is increased to the extent that a better finish results, if loading and unloading can be speeded, or if the fixture itself can be made lighter.

Vacuum clamping was long and thoroughly tested at Douglas before it was ever used in production tooling. From the backlog of experience built up, some interesting facts emerged. Rather surprising clamping power was uncovered. No vibration was encountered during machining, and the work surface remained free of chatter marks. Warpage in the sections of the work-pieces was at a minimum.

Early applications included considerable auxiliary mechanical clamping devices. Increased confidence in vacuum techniques, however, has now reduced the number of mechanical clamps to four or less per fixture. Such clamps serve primarily to hold the work while the vacuum is being applied, and as a safety factor in case of vacuum failure. At times, additional clamps are required to pull slightly warped or misformed parts onto the fixture surface to assist the vacuum to form.

Where the back of the work is flat, rolled aluminum plate is used for the vacuum surface of the fixture. This material is also used where the backing is contoured mildly, in which case the vacuum surface is machined to a corresponding shape.

The heading illustration shows one of these fixtures (at the eye level of the operator) set up on a Cincinnati horizontal Hydro-Tel milling and die-sinking machine. A hydraulic tracing unit directed from the template above the fixture permits three-dimensional milling.

The vacuum is sealed by a rubber extrusion of designated hardness, having the cross-section of a comma, which is cemented into grooves milled in the surface. In the illustration, the grooves ap-

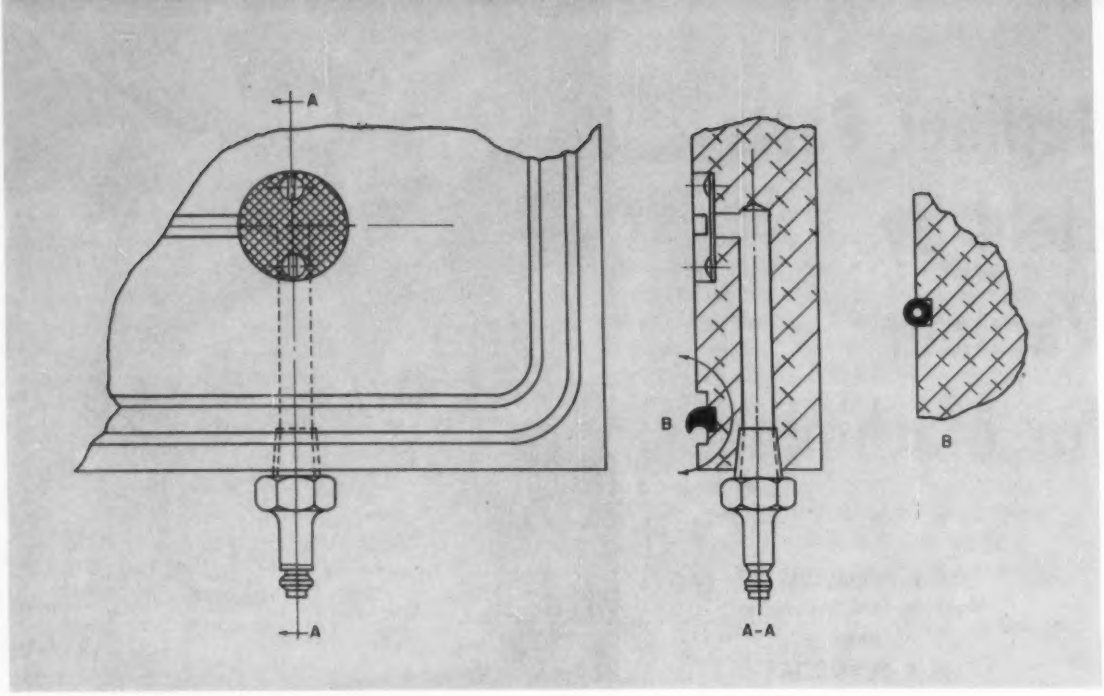


Fig. 1. Section A-A shows the comma-shaped strip in the small groove in the center of the large groove. A round-shaped rubber strip in a single groove (as in area B shown separately) is an alternate seal construction.

pear as dark lines, each of which is a continuous outline of some portion of the surface area. A drawing of a corner of one of the outlines appears in Fig. 1. As can be seen in section A-A, the rubber is contained in a second smaller groove within a larger one.

Each of the outlined areas also has an air-collector groove (the lighter lines seen on the fixture in the heading illustration) which are connected by tubes to the evacuation equipment. In Fig. 2, the work-piece, called a doubler, is clamped to the fixture, and is in the process of being profiled.

Vacuum clamping is also employed on the Cincinnati gantry type milling machine shown in Fig. 3. Here a 3- by 15-foot splice plate undergoes a scalloping operation. To make it easier to handle, the vacuum fixture was constructed in three sections.

Where there is a compound contour in the back of the work, machining the aluminum plate to conform to it becomes time-consuming and costly, so a plastic-surfaced fixture is used. First, a duplicate of the back of the work is made out of plaster. Pieces of wood molding, corresponding to

Fig. 2. The doubler is in place against vacuum fixture. Mechanical clamps make loading and unloading easy and serve as safety devices in case of vacuum failure.

Fig. 3. Because of the length of the splice plate, the fixture plate is made in three sections. Hoses seen on right side of the plate are vacuum lines.

the seal grooves in reverse, are then attached to the plaster. Next, the fixture's vacuum surface is produced by laminating glass cloth and epoxy resin on the plaster duplicate. After curing, the layup is rigged into the structure of the fixture.

In addition to the rubber seals and air-collector grooves, both types of fixtures are equipped with at least two standard air fittings. One fitting is for attachment to the vacuum line. The other, at the opposite end of the fixture, is for a vacuum gage on the machine tool. A low reading on the gage alerts the operator for needed corrective action somewhere around the seal.

Vacuum pumps of 12 1/2 psi capacity are conveniently located throughout the production machine shop. Some areas have permanent installations, while in other areas, where fewer vacuum fixtures are used, a portable pump is used.

Do's and Don't's About Tumbling Media

Tumbling, or barrel finishing, is a surface conditioning operation in which work-pieces, abrasive media, and various compounds are placed in a receptacle and rotated. The operation can serve a variety of purposes: rounding of corners, descaling, deburring, improving surface finish for polishing, and reducing grinding stresses. Large as well as small work-pieces can be tumbled economically on a mass-production basis.

The Electro Minerals Division of the Carborundum Co., Niagara Falls, N. Y., suggests these "Do's and Don't's" about abrasive media:

DO

1. Use large media for rapid burr removal, provided finish is not important.
2. Use small size and well-worn media where a high finish is important and rapid cutdown is not a requirement. Also, use small media on fragile parts.
3. Use a size which will not lodge in holes or recesses.
4. If slots and holes dictate the use of two sizes of media, use approximately 25 per cent of the larger and 75 per cent of the smaller media.
5. Choose a size, or sizes, which can be screened or separated from the parts.
6. Use three to five parts of media to each work-piece by volume for general ferrous work. By increasing ratio of media, finish will be finer, all other factors being constant.
7. Where the ratio of media to parts is 5:1 for steel, use 7:1 for magnesium or aluminum, all other conditions being the same.
8. Have total load (media and parts) 60 to 75 per cent of barrel capacity.

DON'T

1. Don't use large media for fragile parts, as parts may be bent or damaged.
2. Don't use media with sharp edges if a low micro-inch finish is desired.
3. Don't fail to neutralize medium after it has been used and before it is placed in storage bin. Otherwise, the residual contamination may cause undesirable results when used again.
4. Don't fail to screen media after using so that worn pieces reach their respective bins.
5. If nicking or scratching is a problem, don't include a high volume of parts.

High-Temperature Grinding of Carbide Tools

Experiments in heating carbide cutting tools to temperatures between 1380 and 1560 degrees F. during rough sharpening indicate that crazing can be minimized and grinding costs reduced. Also, tools ground in this manner can be operated at higher cutting speeds and are more efficient.

E. ZMIHORSKI, Warsaw, Poland

IN GRINDING sintered-carbide cutting tools or tips with silicon-carbide, aluminum-oxide, or diamond wheels, there is always the problem of possible crazing of the carbide surfaces. Also, sharpening of such tools can be costly because of the rapid rate at which the grinding wheels are worn. In an attempt to alleviate these problems, experiments have recently been carried out with two new techniques—one for rough-grinding with high metal-removal rates, and the other for finish-grinding carbides.

The first method involves raising the temperature of the part to be ground to within 1380 to 1560 degrees F., and maintaining it at this temperature during grinding. It has been found that at this temperature the sintered carbides are considerably less brittle, and, consequently, less prone to crazing. Moreover, the hardness of the material is reduced to a point at which satisfactory results can be obtained by the use of aluminum-oxide wheels, in contrast to more expensive types. In addition, important reductions in the time required to complete the grinding operations have been obtained, as compared with those for conventional methods.

Metal-cutting experiments performed for an average of four hours' cutting time indicated that a lathe tool ground by conventional methods could be operated at a cutting speed of approximately 470 sfpm (surface feet per minute), while a similar tool ground by the new technique could be used at 555 sfpm. Other investigations have shown that with high-temperature grinding, the efficiency of cutting tools can be increased by as much as 280 per cent.

High-temperature grinding has been found to offer the greatest advantages when reclaiming tools which have suffered severe wear on the edges, with associated cracks and fractures, from which large amounts of material must be removed. The cost of regrinding such tools by conventional methods may be so great as to be prohibitive, owing to the time required to remove the damaged portions and the high rate of wear of the wheels. In one instance, a heavy-duty, carbide-tipped lathe tool having a 0.197-inch-long fracture in the carbide tip was rough-ground by the high-temperature method in thirty seconds using a standard aluminum-oxide wheel of 26 grain size. This was very much less than the estimated time for reclaiming a similarly damaged tool by the normal low-temperature method. Depending on the grade of the carbide, tests have shown that metal-removal rates for rough-grinding may vary between 0.183 and 0.366 cubic inches per minute.

In theory, if the temperature of a tool is raised to between 1380 and 1560 degrees F., the adhesion between a brazed tip and the shank is likely to be destroyed. However, in practice, trouble has not been experienced in this connection. When grinding a tool to which the tip has been attached by low melting-point brazing alloy, however, it is considered advisable to clamp the tool in the manner indicated in Fig. 1. This two-point clamp secures both the shank and the tip. The recommended ratio for the distances of the contact points on either side of the clamping screw is 15 to 1.

For certain types of carbide tools, including those of profiled form, the time required for grinding may be comparatively long. In such cases, it may be necessary to make some provision for maintaining the tool at the required temperature and for avoiding oxidation. For such purposes, a jet of burning coal gas (without air) can be arranged to play on the surface of the tool, to keep it at the required temperature and pro-

vide protection against oxidation. For most normal tipped lathe tools, however, such supplementary heating is unnecessary, since, owing to the short time required for grinding, the abrasive friction is sufficient to maintain the preheat temperature.

The most effective method of preheating the tool prior to grinding is by induction, and equipment for this purpose can be provided on the grinding machine. Alternatively, the tool may be raised to the required temperature in a furnace located adjacent to the grinding machine. Also, insulated vise jaws incorporating a resistance-heating arrangement can be employed, as shown in Fig. 2. Advantage may also be taken of the heat applied to the tool when the tip is brazed in position.

A diagrammatic view of a special machine for the high-temperature grinding of sintered carbide is shown in Fig. 3. Tool *A* is held in a swiveling, tilting vise mounted on a table, which is provided with T-slots in the working surface and arranged for movement in both longitudinal and transverse directions. Horizontal grinding is done with the aluminum-oxide wheel at *B*, which is carried on a head that can be adjusted vertically by means of handwheel *C*. Grinding in the vertical plane is done with wheel *D*, which is also mounted on a head which can be adjusted vertically on a column by means of handwheel *E*.

Handwheels *F* and *G* control the transverse and longitudinal movements of the machine table, respectively. Because of the high rates of metal removal which can be obtained in high-temperature grinding, the horsepower of the electric motors used for driving the grinding wheels should be at least twice that required for conventional tool grinding.

Finish-Grinding Technique

High-temperature grinding is intended mainly for roughing operations, or where large amounts of stock must be removed to reclaim badly damaged tips. For finish-grinding, an electrolytic process has been developed which involves the use of special silicon-carbide or aluminum-oxide grinding wheels with a metal bond. To manufacture these wheels, the abrasive grains are sintered with iron powder, the ratio of the two materials varying between 1 to 1 and 1 to 3 by weight. A direct-current electric circuit is set up between the work-piece (anode) and the grinding wheel (cathode) by a continuous flow of sodium-silicate solution weighing approximately 0.048 pounds per cubic inch. This solution carries a current of the order of 24 volts and an amperage of approximately 40 per 0.155 square inch of electrode area. The speed of the wheel varies between 2750 and 3500 fpm (feet per minute), and the pressure per unit area on the wheel during grinding is of the order of 290 to 360 pounds per cubic inch.

In operation, the electric current serves to heat the particles of metal to be removed and facilitates the work of the grinding wheel. Tests car-

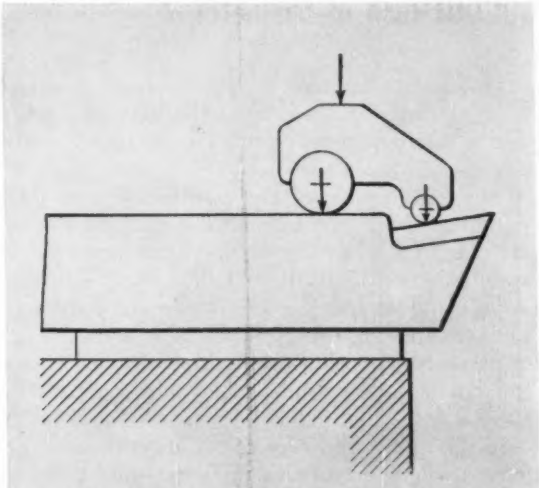


Fig. 1. When grinding a brazed, carbide-tipped tool by the high-temperature technique, a clamp of the type shown may be employed to hold the shank and tip securely.

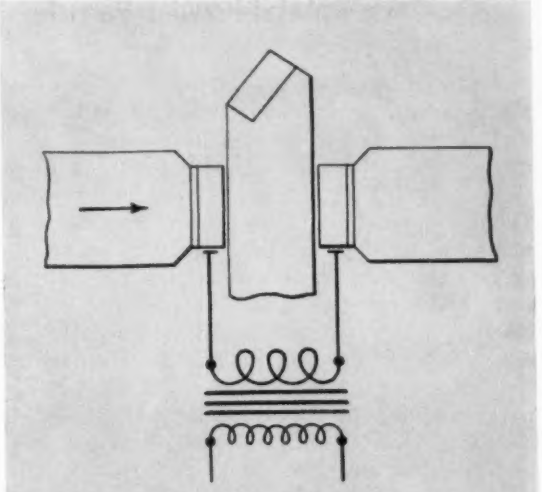


Fig. 2. Resistance-heating setup and pair of insulated vise jaws for raising the tool to required temperature. Heating equipment should preferably be built into machine.

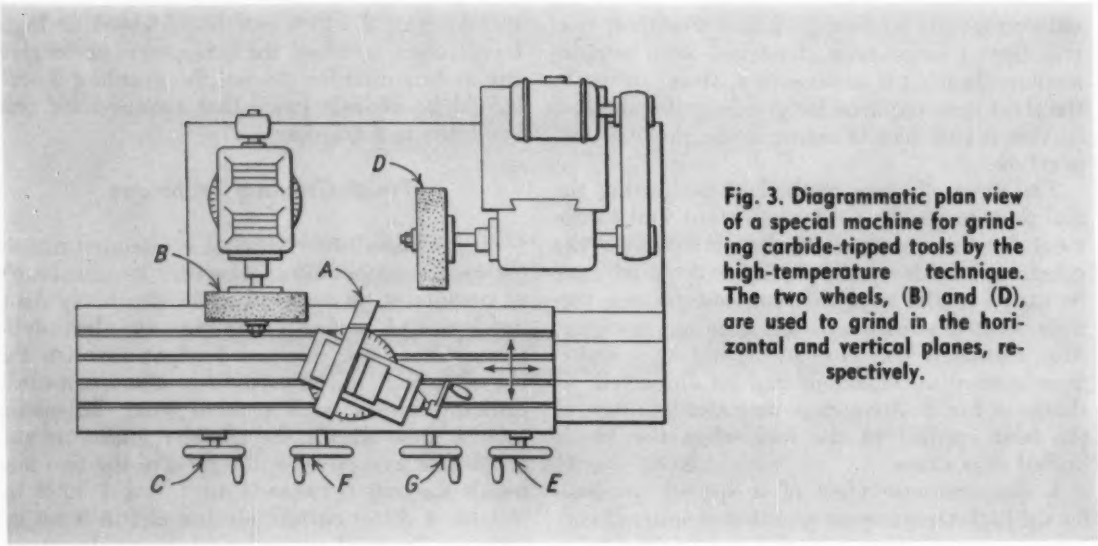


Fig. 3. Diagrammatic plan view of a special machine for grinding carbide-tipped tools by the high-temperature technique. The two wheels, (B) and (D), are used to grind in the horizontal and vertical planes, respectively.

ried out with this method have produced ground surfaces with a surface roughness of 6 microinches at metal-removal rates up to 0.0025 cubic inch per minute. Parts ground in this manner show no signs of crazing, suggesting that this technique may be of considerable value for grinding such components as hardened gear teeth, ball-bearing races, and high-speed spindles, for example. The longer life obtainable from the metal-bonded wheel and the reduced cost as compared with diamond wheels suggest that it may be economical to use the process for high-quantity production work. However, it must be borne in mind that special grinding machines will have to be designed to enable the technique to be fully exploited.

It may also be noted that the metal-bonded wheels have sufficient strength to permit operation at very high peripheral speeds, ranging from 12,000 to 29,500 fpm. With such speeds, it is believed that surface finishes of exceptional quality may be obtained, but it will be necessary to provide machines with suitable spindles and bearings before investigations can be carried out.

Metal-Powder Particles 0.000001 Inch in Diameter

A new method for producing ultra-fine metal powders with particles only one-millionth of an inch in diameter—a thousand times smaller than any previously obtainable—promises to open new vistas in catalytic chemical processing, powder metallurgy, and other industries. The development was revealed by Frederick H. Greene, Jr., vice-president of the National Research Corporation, Cambridge, Mass. The powders are, in effect, completely new materials with remarkably different properties from the base metals of which they are made. Particles are so much smaller than wave lengths of visible light that they all appear black to the human eye—so small, in fact, that the powerful forces existing between individual molecules can be used to great advantage.

First of the metals to receive NRC's consideration for production scale-up has been aluminum. Iron and nickel powders also have been made in the same size range and are expected to offer a large number of new magnetic and electro-magnetic applications. Copper, silver, gold, cobalt, manganese, lead, zinc, the alkaline earths, and a number of other substances appear to be likely candidates.

The significance of the powders lies in their potential ability to enter into or catalyze chemical reactions which the same metals in a coarser state will not do at all, or will do only with the application of large amounts of externally supplied energy in the form of high temperature or pressure, or both. Certain finely divided chemical compounds of metals may also be possible for the first time.

In the field of powder metallurgy, these ultra-fine powders may open up short cuts to new, exact-composition alloys having physical properties superior to the best now known. Simple mixing of desired proportions of various metal powders, compacting into the component part required, and then sintering at high temperature may be all that is involved.

Getting Rid of 1000 Tons of Chips a Month

CHIP DISPOSAL is handled in a highly efficient manner at the Timken Roller Bearing Co.'s new plant in Bucyrus, Ohio. This plant turns out automotive sizes of roller bearings in large volume. It is considered one of the most modern installations of its kind in the country.

Manufacture of the bearing cup and cone is done in a straight line: At one end of the plant, seamless tubing enters; at the other end, the packaged product leaves. All handling of the annual production of 33,000,000 cups and 27,000,000 cones is mechanical. Except for inspection purposes, no pieces are touched by an employe during the entire operation.

One of the problems solved in the development of the production lines was the disposal of chips in the "green" machining department. Batteries of automatic bar machines, varying in size from 1 1/2 to 4 5/8 inches, remove a large amount of metal in a short time. In roughing out the cones, for example, one machine with all-carbide tooling completes eleven different cuts at 500 sfpm (surface feet per minute).

Metal chips and scrap at full production weigh an estimated 1000 tons a month. Without a chip-disposal system as fully automatic as the machine tools themselves, they could not be run at peak levels, and the economies inherent in their use could not be realized. Anticipating the problem, Timken engineers designed two centralized chip-disposal systems that virtually eliminate the need for any manual handling. One system serves the cup line, and the other, the cone line.

Machines are arranged along sluiceways. At intervals, an attendant opens a gate located beneath the bed of each machine, letting the chips fall through. The gate prevents any machined pieces from being dropped into the sluiceway. Coolant is channeled through the same trough, carrying the chips into a collecting pit. The coolant passes through a screen near the bottom of the pit, from where it is recirculated.

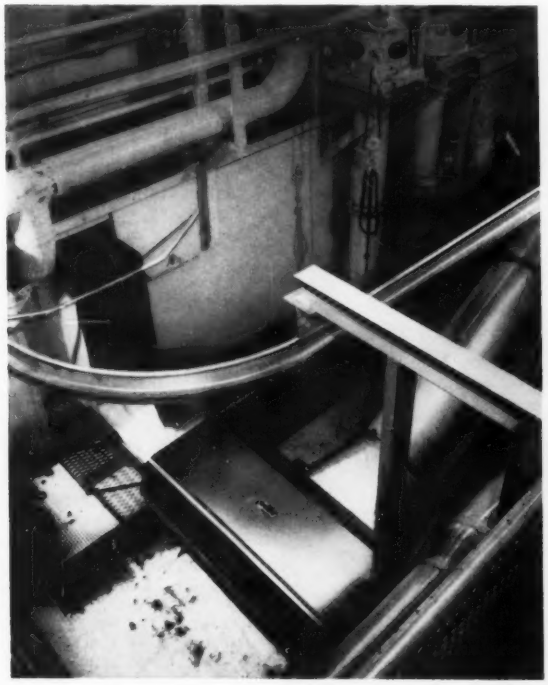


Fig. 1. Chips and coolant from sluiceway in cone machining department flow into collecting pit. Screen protects foot valves in pit bottom from clogging.

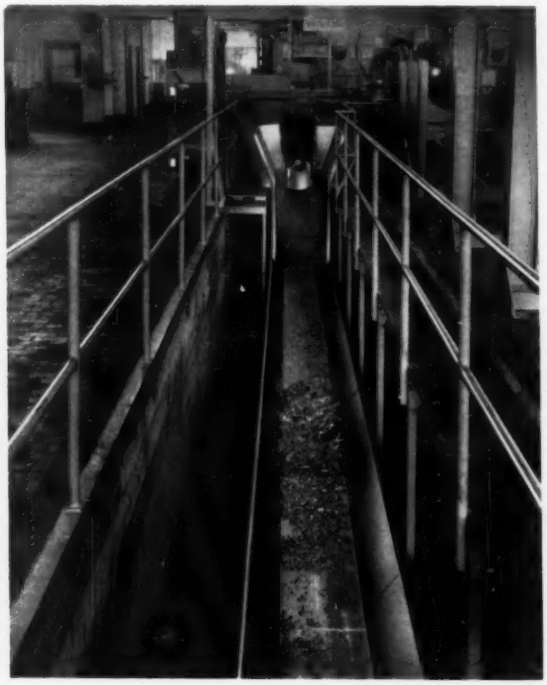


Fig. 2. On this 67-foot long shaking conveyor, chips traverse entire width of department. In background is screw conveyor bringing chips from collecting pit.

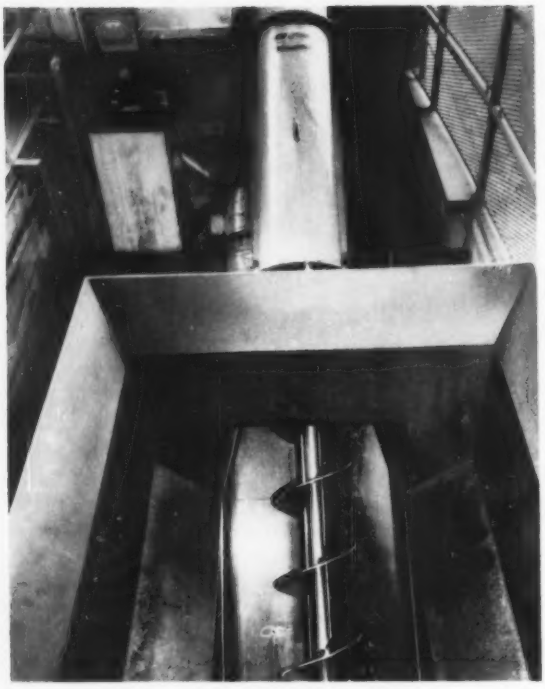


Fig. 3. Third element of conveying system is this screw, up which chips travel from shaking conveyor to dump-truck station.

The accompanying illustrations show the method of chip disposal in the cone machining department. In Fig. 1, a close-up view of the collecting pit, the coolant can be seen flowing from the sluiceway onto the screen. The chips, remaining on the screen, are raised by a screw conveyor, the lower end of which appears on the right in the illustration. Emerging from the top of the screw conveyor, the chips drop onto the shaking (oscillating) conveyor seen in Fig. 2. The latter is inclined slightly, so that the chips move uphill. In this way, coolant still clinging to the chips tends to flow back. The conveyor is controlled automatically so that it is in motion only when there are chips to remove.

When the chips traverse the shaking conveyor, they drop onto a second screw conveyor, Fig. 3, which elevates them to a dump-truck station, Fig. 4, outside the building. Trucks return the scrap to the Timken steel mill in Canton, Ohio.

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How It Got Its Name

Around 1520, in Saxony, a blue pigment was produced from complex arsenical silver-cobalt-nickel-bismuth ores. On smelting, these ores gave a speiss, metallic in appearance but brittle and of no practical use. The miners of that time, unable to refine this material, saw therein the workings of "Kobold," the German word for goblin. Hence the name of one of the metals included in this speiss. Metallic cobalt was first used in 1910 as an alloy in high-speed steels. Since then, cobalt has become indispensable in many alloys.

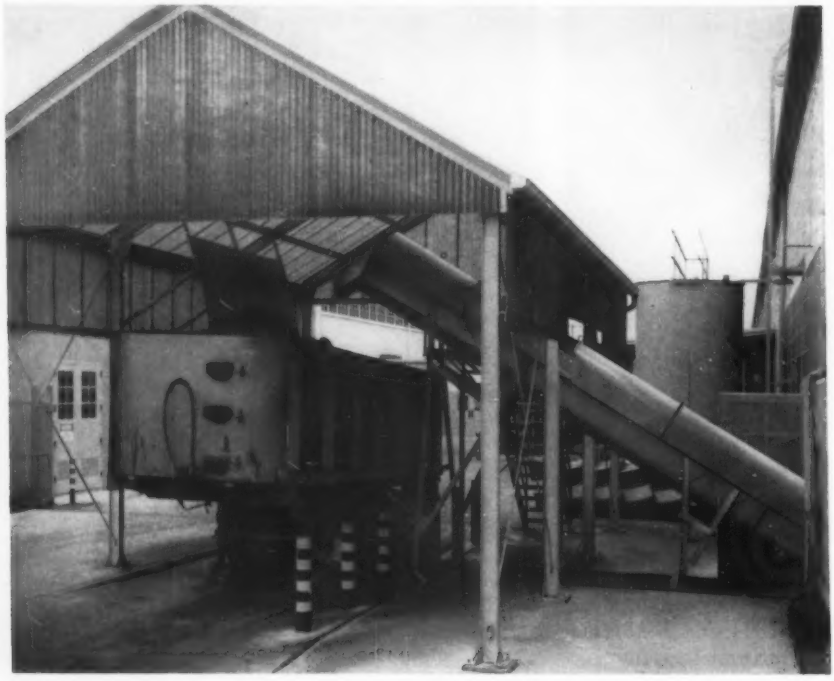


Fig. 4. Entering body of dump trucks, chips are hauled away to feed Timken's electric melting furnaces at Canton.

MATERIALS

The properties and new applications of materials used in the mechanical industries

Oversized Flat-Ground, Oil-Hardening Tool Steel Available

A flat-ground, oil-hardening tool steel ground 0.014 to 0.016 inch oversize on the thickness dimension has been announced by Latrobe Steel Co., Latrobe, Pa. This steel, designated "Badger," is an 01 type tool steel with a tungsten and chromium content that gives it improved wear resistance.

The extra thickness allows finishing to nominal dimensions after heat-treatment. Use of this steel is recommended where improved wear resistance over straight manganese type steels is required. It is also used for blanking dies, punches, cold-forming dies, gages, jigs, fixtures, templates, and machine parts.

Solvent-Proof Synthetic Chamois for Industrial Cleaning

An industrial cleaning tool called "Chamie-Tex" which can be used wherever natural chamois is desirable for all wiping and cleaning jobs has been made available by Milwaukee Dustless Brush Co., 530 N. 22nd St., Milwaukee 3, Wis. It is made chiefly of oil and solvent-proof nitrile rubber and can be used in gasoline, kerosene, and other harsh industrial solvents. It is ideal for cleaning machine parts. When used for cleaning greasy machinery, a simple rinsing in a solvent, after use, removes all grime from the cloth. It can be washed in any soap or detergent, always remaining soft, wet, or dry. It will not crack or tear.

One-Part Epoxy Compound for Bonding

A one-part, 100 per cent epoxy adhesive that cures at moderate temperatures and requires no mixing or metering has been announced by Isochem Resins Corporation, 221 Oak St., Providence 9, R. I. This adhesive, called "Isobond 331," has been designed for high-speed production use to bond metals, glass, ceramics, and most plastics. When bonded to aluminum, it has a shear strength of 3000 psi. The material is stable at room temperature and can be fully cured in two and one-half hours at 250 degrees F. or in fifteen minutes at 330 degrees F. It is resistant to most acids, alkalies, and solvents, and can be used safely at operating temperatures of from −70 to 175 degrees C. Since the adhesive is moderately resilient, materials with a wide range of expansion coefficients can be bonded without causing thermal stresses.

Boron Carbide Compound for Lapping and Polishing

A preparation for lapping carbide dies and tools and polishing plastic molds has been announced by the Titan Tool Supply Co, Inc., Box 3, 1419 Hertel Ave., Buffalo 16, N. Y. The product, known as "Tetrabor Paste," is a ready-to-use compound of special oils and boron carbide that closely resembles diamond in hardness and specific weight. It is available in 100-gram tubes in a range of from 100 to 1200 grit.

Hard, High-Strength Stainless Steel for Use at Elevated Temperatures

A strong, hard, erosion-, oxidation-, and corrosion-resistant material for service at temperatures of 900 to 1600 degrees F. has been announced by Armco Steel Corporation, 1939 Armco Ave., Middletown, Ohio. The material, called "Armco 22-4-9," is available as forging billets and rounds from 3/8 to 3 inches, inclusive. It has the following nominal percentage composition: carbon, 0.52; manganese, 8.5; phosphorus, 0.045 max.; sulphur, 0.12 max.; silicon, 1.00 max.; chromium, 21.5; nickel, 4.0; nitrogen, 0.40; and iron, the balance.

At room temperature this material exhibits a controlled hardness between 300 and 550 Brinell depending on the method of processing. It is non-magnetic. Typical properties after heat-treatment and aging are as follows: ultimate tensile strength, 160,000 psi; yield strength (0.2 per cent offset), 108,000 psi; elongation in two inches, 8.0 per cent; Brinell hardness, 343. The

minimum hardness in which this material can be supplied ranges from 30 to 35 Rockwell C.

It is recommended that machining be done either in the hot-rolled condition or after heat-treating to 2150 degrees F. for 1 hour, then water quenching and heat-treating to 1400 degrees F. for 14 hours, and air cooling. Machining is best done with carbide-tipped tools. Cutting is most successfully accomplished with lubricated abrasive discs or by hot-shearing. This material should not be cut with an abrasive disc without use of a lubricant. It is readily hot-forged or upset. The initial forging temperature may range from about 2000 degrees F. to 2400 degrees F., depending upon the size of stock, the part design, and the amount of work to be done.

This steel is a weldable alloy and can be joined by any of the methods used for stainless steel. Because of its austenitic structure, this grade can be welded without preheating or post-heating and is not susceptible to cracking. It has been used for making high-temperature steam valves and gas-turbine parts.

Brazing Alloy Features High Strength to 2200 Degrees F.

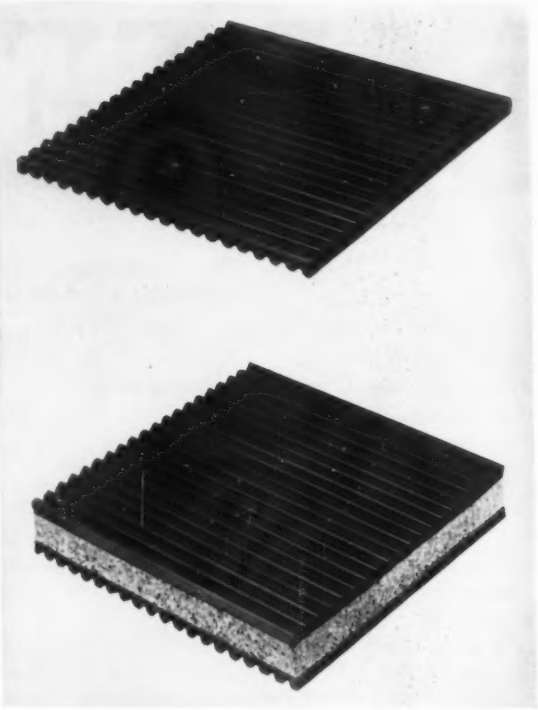
A nickel-chromium-boron brazing alloy which is applicable to most "super alloys" has been made available by Stainless Processing Division, Wall Colmonoy Corporation, 19345 John R St., Detroit 3, Mich. Designated "Nicrobraz No. 170," the material produces high-strength joints for continuous service at temperatures from room temperatures to 2000 degrees F. and can be used up to 2200 degrees F.

The material will satisfactorily braze tungsten and molybdenum bearing alloys. It has good wetting characteristics. Its recommended brazing range is from 2150 to 2200 degrees F. in pure dry hydrogen. Available as a powder, the material is best used as a mixture with Nicrobraz cement. It can be applied with a brush, glass dropper, or other suitable means.

Neoprene Mounting Pads that Cut Machine Vibration

Two types of Neoprene mounting pads for isolating vibration, preventing machinery travel, and deadening noise have been made available by T. R. Finn & Co., Inc., 200 Central Ave., Hawthorne, N. J. Both types, known as "Pad-Zorbers," are 18- by 18-inch ribbed sheets that can be cut to any shape to fit under the feet of punch presses, drill presses, lathes, and other machinery. They can be trimmed quickly and easily with knife or shears.

These sheets have deep, rugged cross-ribs molded on each side, with the ribs on one side at right angles to those on the other. Both types of sheets are manufactured in load ranges up to 3500 psi and may be used without bolting or built-up bases. Under extremely heavy loads, steel bearing plates are recommended to assure even load distribution. The second type of Pad-Zorber sheet contains a "sandwich" of "Isolant," a special isolating material which, in effect, floats the unit to be isolated on a cushion of air.



The materials shown here are used for suppressing vibration transmission, deadening noise, and preventing machinery from moving. The lower sheet incorporates the use of a special, cork-like isolating material. Both types can be trimmed with knife or shears and are of Neoprene construction.

"Liquid Aluminum" Material that Hardens to a Machinable Solid

A liquid aluminum material that can be cast without heat or pressure has been developed by Devcon Corporation, Danvers, Mass. Called "Devcon F-2," this material becomes liquid upon the addition of the hardening agent. Two hours after the hardener is added, it is a tough, durable, metallic mass that is similar in appearance to aluminum or steel.

The hardened material has excellent physical properties (compressive strength is 20,000 psi) and is unaffected by most oils, chemicals, and solvents. It bonds aluminum, steel, bronze, wood, ceramic, and many other materials to itself or

each other. Non-shrinking and non-expanding, it also has good abrasion resistance.

The material can be drilled, tapped, or otherwise machined with metalworking tools. It has been used to fill large and small blowholes in castings, to fill holes which have been drilled incorrectly, and to build up worn sections of cast or machined parts. Other applications have been the making of core boxes, patterns, matchplates, jigs, fixtures, and vacuum forming dies.

Epoxy Resin Conductive Coating for Rebuilding Worn Areas

A conductive coating based on epoxy resins which has a low volume resistivity, good toughness, and good adhesion has been announced by Houghton Laboratories, Inc., Olean, N. Y. The compound, called "Hysol 6251," is recommended for rebuilding areas worn away by sliding contacts and to serve as a conductive base for plating plastics. The coating may be cured in 48 hours at room temperature or in 7 minutes at a temperature of 300 degrees F. Volume resistivity at 25 degrees C. is 0.0008 ohm-centimeters.

Spring Wire for High-Temperature Use

Spring wire made of Inconel X has been introduced by National-Standard Co., Niles, Mich., for components that operate between 650 and 1000 degrees F. The wire, called "Superalloy Spring Wire," is heat-treatable and can be precipitation-hardened. It is available in an annealed condition from 0.005 to 0.166 inch in diameter, in spring temper from 0.005 to 0.180 inch in diameter, and in No. 1 temper from 0.005 to 0.230 inch in diameter.

Spring temper is recommended for operating temperatures from 650 to 750 degrees F., the tensile strength ranging from 190,000 to 270,000 psi, depending on wire diameter. Wire of No. 1 temper is recommended for operating temperatures from 650 to 1000 degrees F. and tensile strengths range from 130,000 to 165,000 psi, depending on wire diameter. The wire is available in copper, lead, cowles lime, lime-oil, and bright finishes.

Low-Carbon, Precision-Ground Flat Stock

A low-carbon steel flat stock for unhardened and casehardened use has been made available by Brown & Sharpe Mfg. Co., Industrial Products Division, 235 Promenade St., Providence 1, R. I. The stock, called "Thrift" low-carbon, precision-ground flat stock, is precision-ground to a satin finish of 35 micro-inches or better and has free machining characteristics. It may be casehardened to 1/32 inch by submergence in carburizing salt to obtain high tensile strength, yield point, and hardness. The flawless surface, square corners, and flat parallel sides should eliminate costly finishing operations.

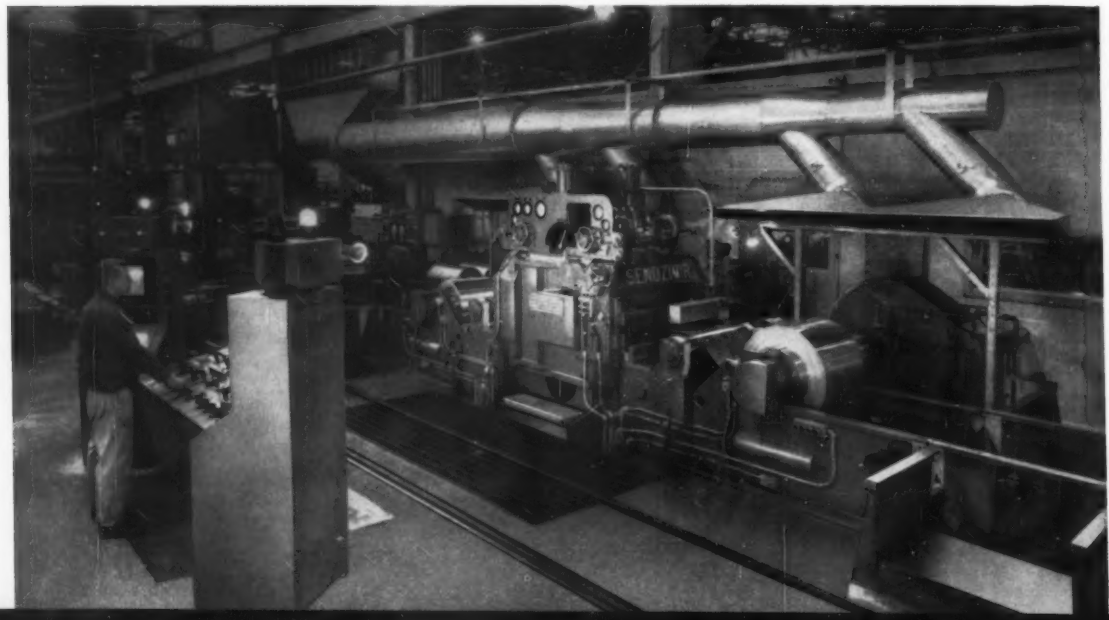
Each piece is individually packaged for protection and marked along its entire length to eliminate mistaken identity when removing partially used pieces from stock shelves. Applicable to a variety of jig, fixture, tool, gage, and part-making jobs, it is available in sizes, all 24 inches long, but ranging from 1/16- to 2 7/8-inch thickness, and up to 16 inches in width.

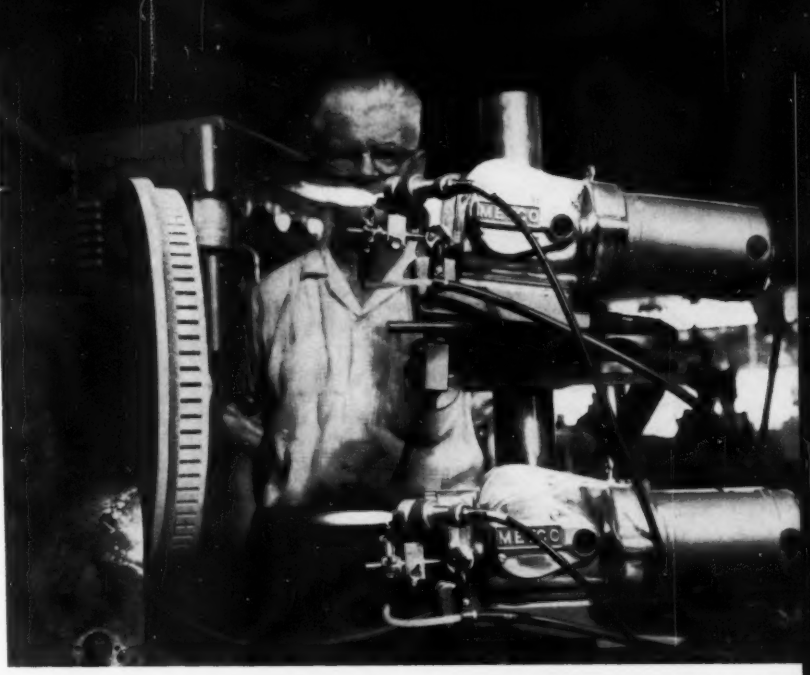
These two halves of a special tool-steel die made of "Potomac M" are used in the manufacture of rotors. The six rotors are cast simultaneously by centrifugally die-casting molten aluminum around the laminations with motor shafts already inserted. The use of this special tool steel, made by Allegheny Ludlum Steel Corporation, Henry W. Oliver Bldg., Pittsburgh 22, Pa., resulted in an average die life of more than two years.

Camera highlights of some interesting operations performed in various metalworking plants

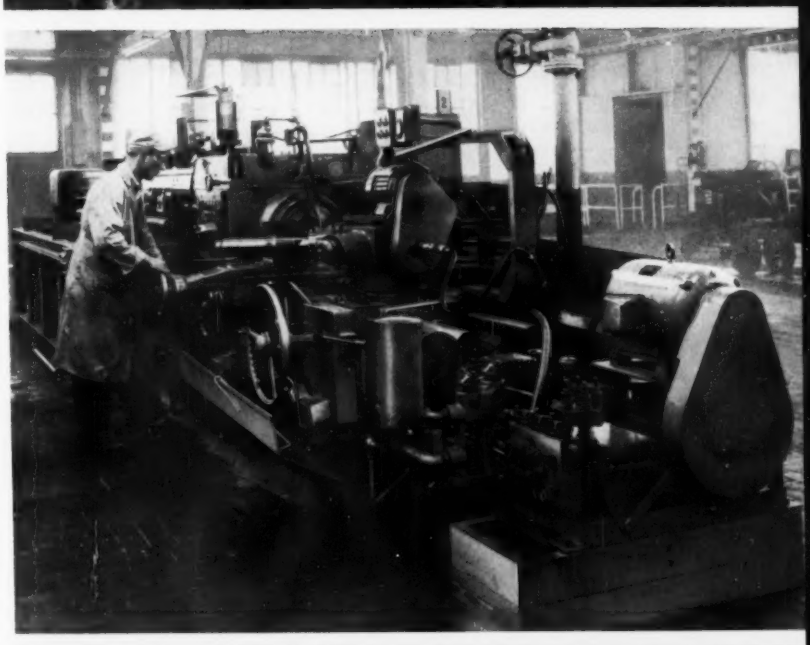
FERRIS WHEEL—Both ends of camshafts go through a series of operations simultaneously on this Natco machine in Chrysler's Trenton, Mich., engine plant. The work is loaded in fixtures which are spaced around an indexing drum. Operations consist of milling both ends to length; rough- and finish-drilling manufacturing centers; and drilling, chamfering, semifinish- and finish-reaming the timing hole. Fixture clamps are hydraulically actuated.

NEW ROLLING MILL—Radio-isotopes and electronics aid in controlling strip thickness on this new brass and aluminum rolling mill at the Scovill Mfg. Co., Waterbury, Conn. Non-contacting gaging units having a radio-isotope source and detector traverse the moving strip, providing readings at any desired point. Through an automatic controller, information from the gages is translated to a continuous feedback of the mill's work rolls.



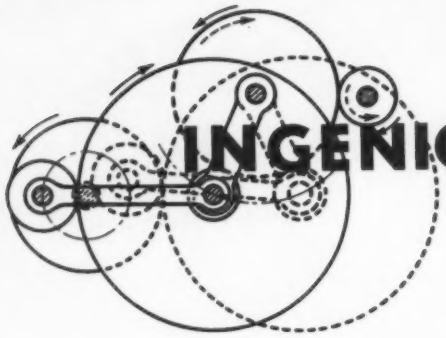


METAL SPRAY—At Pratt & Whitney Aircraft, East Hartford, Conn., Metco apparatus melts and sprays a corrosion-resistant aluminum plating on jet-engine turbine supports. The wire, 1/8 inch in diameter, is drawn through twin gas-head nozzles, where it is melted and sprayed onto the work. A company-designed fixture rotates the work, and a 0.001-inch thick plating is deposited in about twenty seconds.



MODERN TURRET LATHE—A contour attachment and a gun drill are integral parts of this new Warner & Swasey saddle type semi-automatic turret lathe, used by the Timken Roller Bearing Co., Canton, Ohio, in the machining of large tapered rollers. The gun drill completes the center hole of the rollers in a single operation. The contour attachment traces the roller shape. An automatic bar feed holds six bars, eliminating manual loading.

FLEXIBLE MANDREL—This new tube-bending mandrel developed at the Boeing Airplane Co., Wichita, Kan., can produce required radii as small as two diameters. A threaded pin with a spherical head interconnects a series of steel balls. The head of the pin fits into a spherical seat in the ball, permitting movement in any direction.



INGENIOUS MECHANISMS

Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices

Machine "Stops" Roll Labels Momentarily for High-Speed Die-Cutting

RALPH T. STEWART, Winston-Salem, N. C.

Repetitive operations are sometimes performed on lengths of material that are moving at high speed. Generally, the tool is allowed to move with the work, but the patented mechanism here illustrated momentarily "stops" the moving material long enough for a stationary tool to function. The work, however, passes through the device at a constant, high speed.

The mechanism was designed for die-cutting labels previously printed on rolls of paper stock called "web." Six rows of labels, printed on the web, are cut simultaneously by the die. Enough material is left between the labels within the rows so that the labels can be removed from the machine in rolls. Thin strippings which are left between the rows of labels are separated from them and diverted downward by a stripping mechanism (not shown).

A roll of printed label web *A*, subsequent to being placed on spindle *B* of the machine, is unwound a few turns. The loose end of the web is then threaded around rollers *C* and *D*, over dieplate *E*, around rollers *F* and *G*, over roller *H*, and onto cores *J*. Web is built up on the core by a drive through friction discs *K* which are held together under the pressure of light springs (not shown). This allows the core to rotate at a variable speed while taking up the web at a constant rate. Spindle *L* and the friction discs are driven by a separate small motor which runs constantly to keep the labels taut and thus prevent them from being torn by the stripping mechanism.

The upper member *M* of the cutting die reciprocates vertically on guide posts *N*, which are secured in the fixed lower die member. Member *M* is driven by a pair of connecting-rods *O*, eccentrics *P*, and a shaft *Q*. In addition, shaft *Q*, by means of a third eccentric drive and connected linkages, reciprocates rollers *D* and *F* in a short arc.

Connected linkages include driving disc *R*, connecting-rod *S*, lever *T*, rocker shaft *U*, lever *V*, link *W*, frame *X*, and two pairs of parallel levers *Y* and *Z*. Driving disc *R* has a radial T-slot for adjusting the length of stroke of connecting-rod *S* by repositioning its pivot pin. Levers *Y* and *Z* pivot on shafts *AA* and *BB*, respectively, but are always parallel.

Each pair of rollers is driven in opposite directions by means of identical gears *CC* and roller shafts *AA* and *BB*. These shafts are rotated at the same speed in the same direction by a roller chain drive. Pillow blocks mounted on the machine frame support the shafts.

When shoulder screws *DD* are loosened, springs force the rollers apart. Since the rollers are rubber-covered, this provides a means of releasing the pressure on the rollers to prevent the formation of flat areas during long periods of disuse.

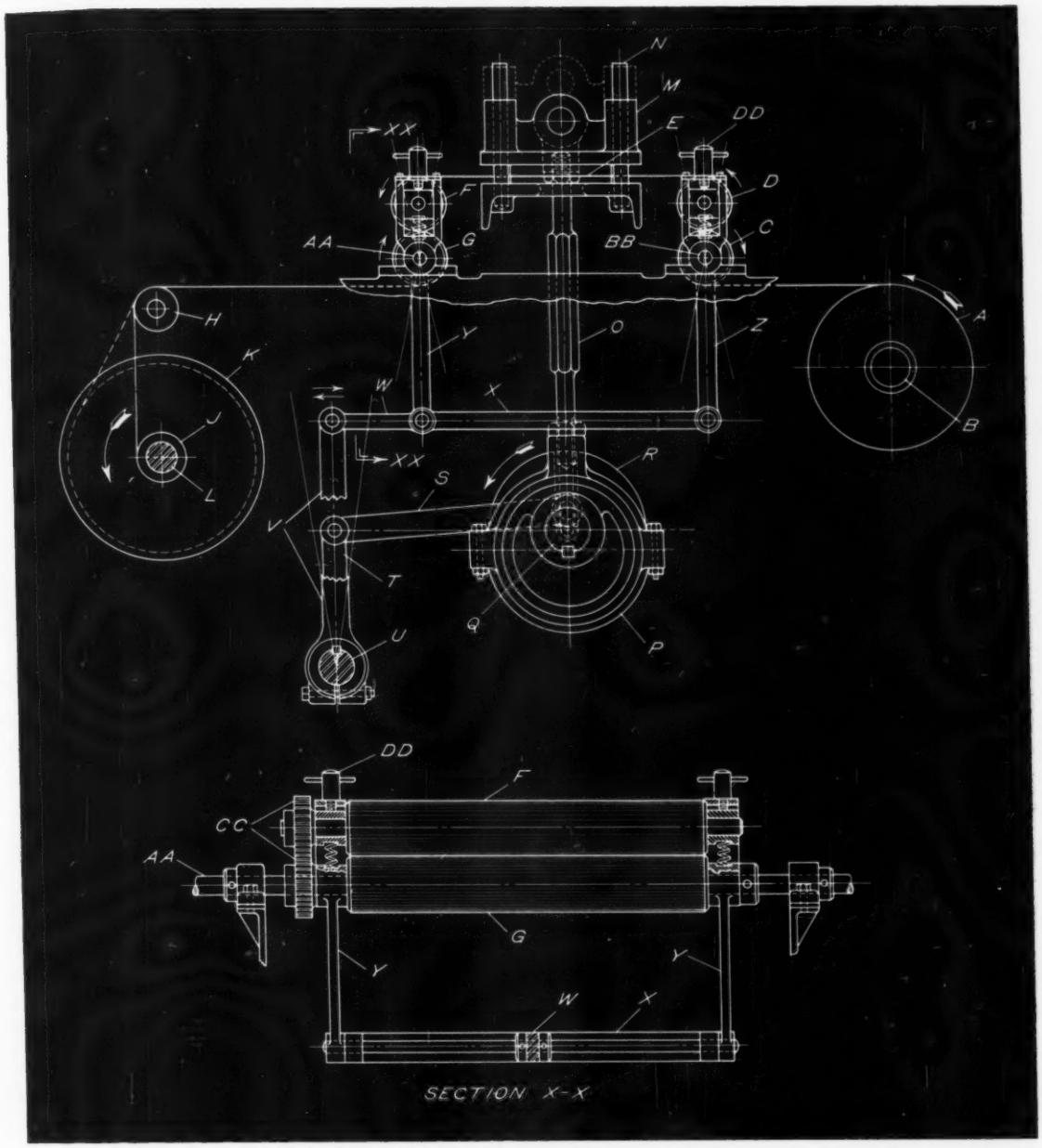
In operation, the web is driven at a continuous speed by the rollers, but the rocking action of rollers *D* and *F* varies the absolute motion of the section of paper stock located between these rollers and under the die. In order to "stop" the work momentarily for the die-cutting operation, the backward motion of the rollers must be made approximately equal to the forward motion of the web relative to the rollers. This is accomplished by varying the rotational speed of the

rollers so that they feed the proper length of web forward for the cutting die. To eliminate any strains in the web the stroke of rollers *D* and *F* is then reset by adjusting the stroke of connecting-rod S. On the forward stroke, the absolute speed of the web will be accelerated and will average out to the rate at which it is fed over the rollers.

The eccentrics are timed so that the die cuts the label as the web is "stopped" on the die-plate. In the illustration the mechanism is shown in this position. As the labels are made in various lengths, the speed of the web over rollers and the stroke of rollers *D* and *F* must be adjusted for each size.

A typical application of this machine is the cutting of 6000 labels per minute. The high rate is obtained by operating the die at 250 strokes per minute and cutting twenty-four labels per stroke, distributed in six rows.

With this mechanism, printed roll labels are momentarily held stationary and die-cut. The label web enters and leaves the device at a constant high speed.



Hydraulic Gear-Shift Control for Speed-Change Mechanisms

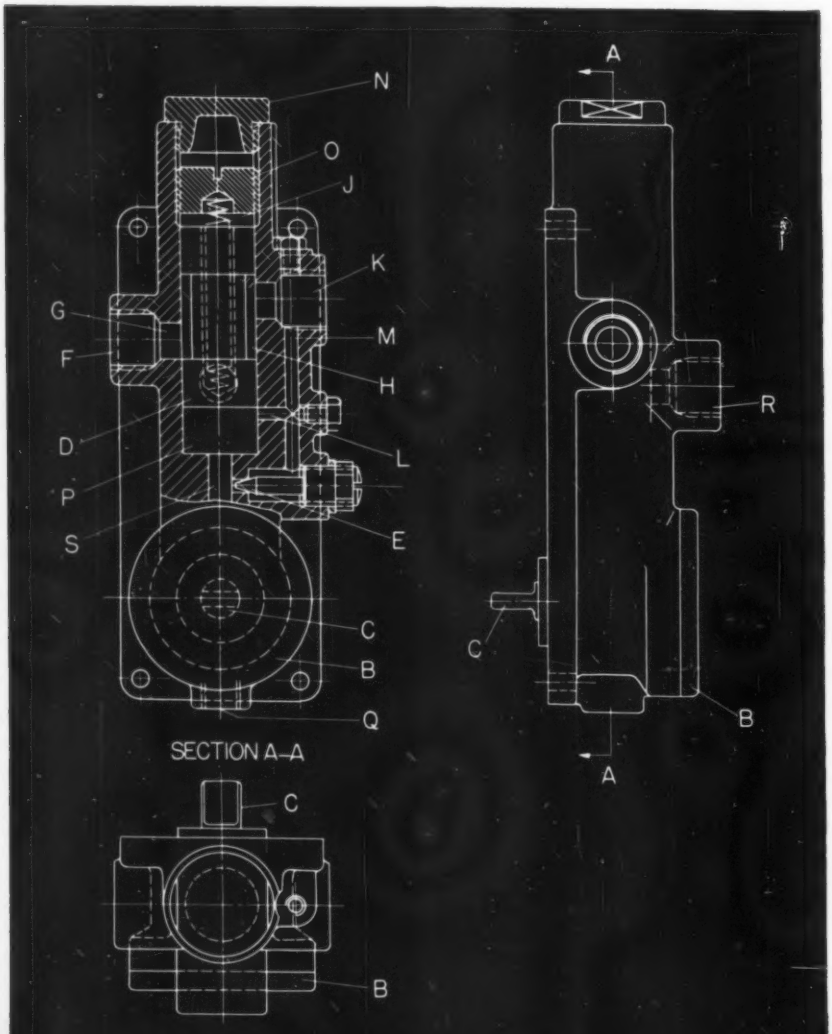
FRITZ TWELSIEK, Dusseldorf, Germany

For controlling modern speed-change mechanisms that incorporate sliding gears or jaw-clutch couplings, hydraulic systems are being widely used. Generally, the gears of such mechanisms run at a speed that is too high to permit changing the speed under operating conditions. To overcome this difficulty, either slow-motion features are embodied in the design or provision is made to prevent the gears from being shifted prematurely, that is, before the speed has been reduced to a rate suitable for the purpose.

An automatic hydraulic control system that meets the requirements mentioned is shown in the accompanying illustration. (Note that the views in this illustration are in accordance with the European system of projection.) This system is of conventional type, using an oil pump which serves to lubricate the gearing or the machine driven by it—as for instance, a machine tool. It also supplies oil under the pressure required to effect the control. The system is composed mainly of a small gear type or plunger type auxiliary pump *B* which has its driving shaft *C* coupled to a constant-speed shaft of the gearing; a spring-loaded control valve *D;* and a throttle *E*.

When the gearing is in operation, oil drawn by the auxiliary pump through bore *Q* is carried through bore S into cylinder *P*. The oil lifts control valve *D* against the action of spring *J* so that the stream of oil coming from the main pump (not shown) and entering the system at orifice *F* is permitted to pass through annular space *H* and flow freely at orifice *K* to effect the lubrication. The additional amount of oil supplied by pump *B* is also fed to the lubricating pipe through passages *L* and *M*. The oil pressure can be varied by means of set-screw *O* after removing plug *N*.

When the gear mechanism is stopped by disengaging a clutch between the driving motor and the gearing, less oil is supplied by pump *B* and the control valve *D* will then drop because of the pressure exerted by spring *J*. This is accomplished at a rate which depends upon the adjustment of spring *J* and throttle *E*. Oil coming through cylinder *P* is then allowed to escape through passage *M* into the lubricating pipe. In moving downward, control valve *D* opens the pressure pipe *R*. As the main pump continues running, the oil it supplies is fed through a distributor to pistons for moving the gears. Thus, smooth shifting is insured.



This hydraulic mechanism assures smooth shifting of gears.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Building-Block Depth Gage

CARL R. SIVITS, Toledo, Ohio

The depth gage shown in the accompanying illustrations is both unique in design and universal in application. By adding or removing sections, the gage body can be lengthened or shortened in a building-block manner to permit use with a wide variety of work-pieces. Many different depths can be checked with this tool by replacing the gage pin with one of appropriate length.

Distance between the face of an internal boss and a mounting flange is shown being checked in Fig. 1. Gage bar *A* is drilled to receive the gage-rod assembly consisting of a gage-pin adapter *B*, gage pin *C*, and contact tip *D*. The gage pin has a threaded shoulder on one end and a tapped hole in the other end so that the guide-rod assembly can be altered quickly.

A tolerance block *E* is seated in a recess in the top face of the gage bar. When tightened down by two screws, the upper face of the tolerance block is flush with that of the gage bar.

The depth dimension to be checked in the illustrated case is 0.750 plus 0.000 minus 0.010 inch. To set the gage for this reading, the top end of the gage-pin adapter is placed flush with the upper face of the gage bar and locked with set-screw *F*. A proper-sized gage pin and a contact tip are then assembled to the adapter. If the distance from the lower surface of the gage bar to the lower surface of the contact tip is not quite 0.750 inch, a spacer *G* of adequate thickness can be used.

To allow for the 0.010-inch tolerance, a spacer *H* of this thickness is placed beneath tolerance

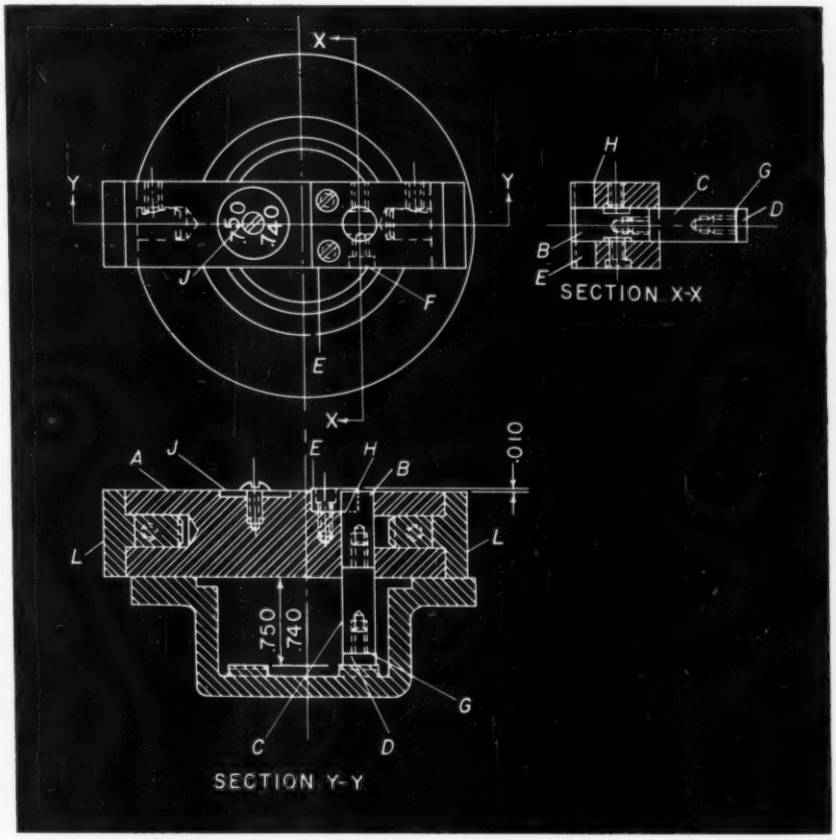


Fig. 1. By altering the length of gage pin (C) and the thickness of tolerance spacer (H), this depth gage can be used in many different applications.

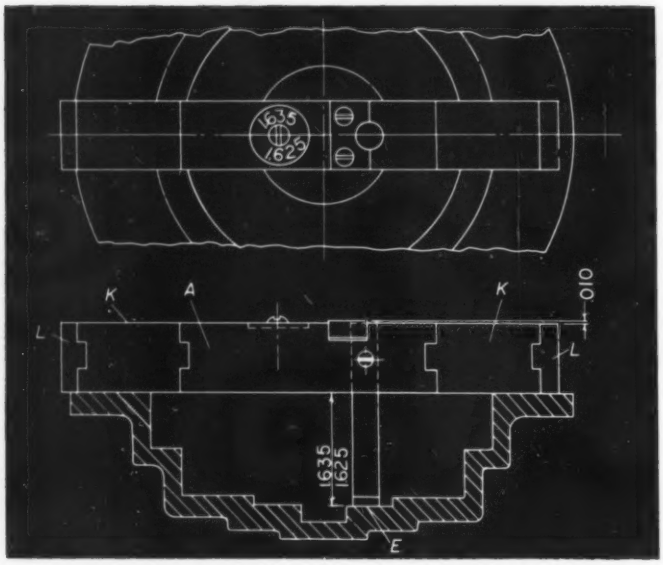


Fig. 2. Further alteration of the basic gage bar (A) can be made by adding one or more extension units such as those indicated at (K).

block *E*. The gage can be identified with the setting of the gage rod by stamping the tolerance range on a thin replaceable nameplate *J*. Upon release of set-screw *F* the gage is ready for use.

As shown in Fig. 1, the gage bar is positioned across the flange of the work-piece. The top of the gage rod is then pressed down firmly so that contact tip *D* rests solidly on the boss to be checked. If the work has been machined correctly, the upper end of the gage-pin adapter will be located between the upper face of the tolerance block and the upper face of the gage bar. An offset tip can be easily made up to check otherwise-inaccessible internal surfaces.

An example of the building-block nature of this gage can be seen in Fig. 2. Here, a short extension *K* has been added to each end of the gage bar *A* to accommodate a large-diameter work-piece.

To permit the joining of additional units, the ends of the gage bar are blind-drilled and have shallow slots milled across them. This hole-and-slot arrangement receives protector caps *L* (Figs. 1 and 2) which are always placed at the ends of the gage. The caps are secured by set-screws.

Each extension bar has a drilled hole and a milled slot at one end, and a turned protrusion and a milled tongue at the other end. In this way, any number or size of extensions can be added to the main gage bar.

Taper-Threading Attachment for the Lathe

Jose C. Sobkowiak, Jackson, Mich.

Chasing taper threads on an engine lathe with the aid of a taper attachment is a relatively simple operation. In small shops where these attachments are not always available, the arrangement seen in Fig. 1 can be a handy substitute.

The taper is controlled by a template *A* that is fastened by two cap-screws to a template holder *B*. This holder is machined to fit the ways of the lathe and is positioned on them so as not to interfere with the carriage. A strap and a bolt are used to clamp the holder in place (Fig. 2). The rear edge of the template is straight and is mounted parallel to the ways and the front edge is machined to one-half of the total taper required on the work-piece *C*. Template holder *B* is made high enough to position the bottom of the template on an even plane with the lower cross-slide *D*. Conveniently, follower *E* is fastened to the upper cross-slide *F* by utilizing the threaded holes used for the chip guard and two cap-screws.

Guide *G* is machined to fit the dovetail on the lower cross-slide, is split along one side of the dovetail, and is clamped in place by means of a stud and a nut. For a precise following action, the areas of contact between the template and both the follower and the guide are held to a minimum by providing the clearance shown in Fig. 1. A tension spring *H* is stretched over the two pins *J* to hold the follower in constant contact with the template. When the carriage moves along the ways for the threading operation, the

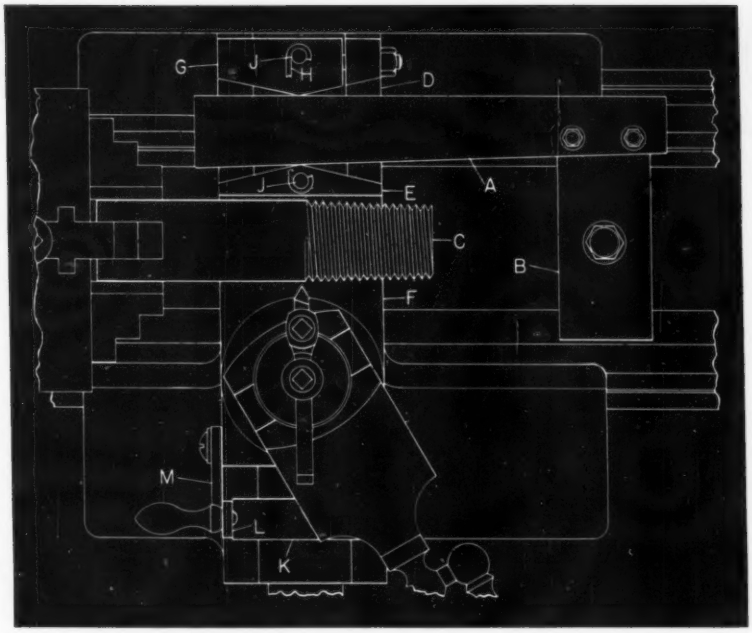


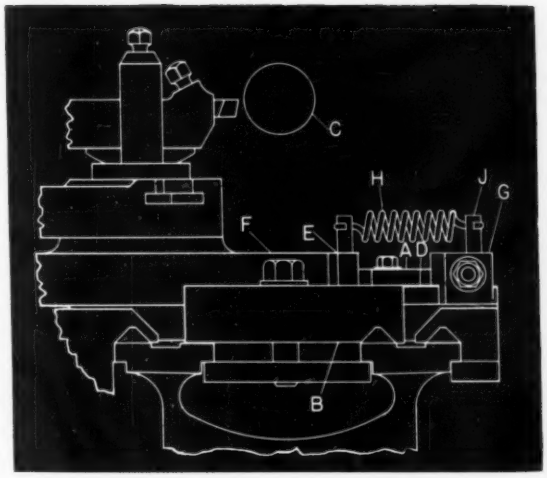
Fig. 1. (Left) An attachment that facilitates the cutting of taper threads on a lathe.

Fig. 2. (Below) Side view of template and follower arrangement for the taper thread-cutting attachment shown in Fig. 1.

cross-slide follows the taper on the template, the cross-feed screw having been disengaged.

As shown in Fig. 3, dovetail clamp *K* is attached to the lower cross-slide *D* in front of the upper cross-slide *F*. Lever *L* has a handle and is pivoted on a screw mounted in the clamp *K*. Link *M* is pivoted on both the upper cross-slide *F* and lever *L*. Special screws are used for the pivots.

After a cut has been made, the handle on lever *L* is pulled toward the operator causing the tool to become disengaged from the work. While the operator holds the handle in this position, he moves the carriage back to the starting point. The tool is then set for the next cut by releasing the handle and adjusting the feed-screw on the compound slide. The compound is not backed off since the tool is disengaged by the lever *L*. Once the proper depth has been reached, the compound dial reading is noted and the tool is backed off for another work-piece.



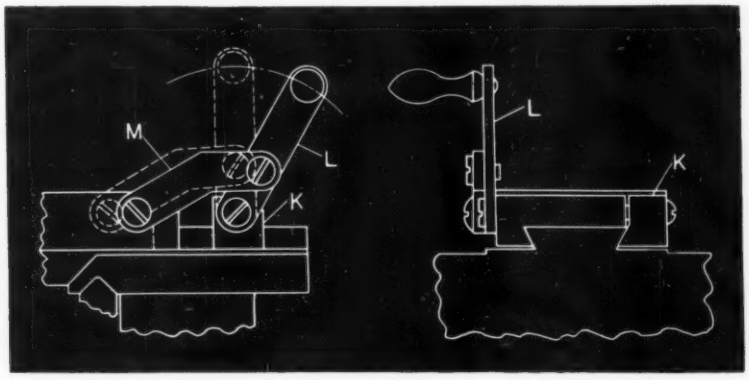
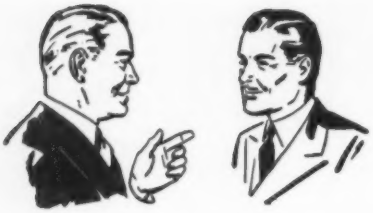


Fig. 3. This quick-acting mechanism for backing off the cross-slide is a feature of the taper-threading device.



Talking With Sales Managers

BERNARD LESTER
Management Consulting Engineer

Do You Suffer from "Specialitis"?

EVER HAVE a small job done at your house which required a variety of skills? We have—one which required a plumber, carpenter, electrician, *and* plasterer. And the cost? Exorbitant—mostly overhead. The same practice of specializing skills, when applied to selling, may prove very costly as the quantity of available business falls.

A search for the best way to reach our markets is more necessary today than ever before, since a revolution has been taking place in customer needs, buying habits, and location. Besides, the equipment we make and sell has changed. The urge to reduce marketing costs is more acute.

This year a great deal of thought is being given to a long-standing problem—whether to align the sales personnel to concentrate their effort according to types of equipment sold or to individual segments of the customer market.

Decentralization of industrial plants for production has become popular in recent years. It has been inspired by the desire to produce under the best labor conditions, to get closer to the market, to avoid red tape due to the widening gap between managers and workers, and to attain efficiency through adapting the plant to the individual product. On the other hand, centralization within the production unit itself has been a necessary result. Responsibility must be localized.

What happened to marketing and sales during these years when decentralization progressed and each plant became specialized and an independent whole? There has been a trend toward decentralization, that is, toward organizing the sales function at headquarters and in the field, as well as toward measuring the results according to a classification of products made and sold. At the same time there has been a trend toward centralization of all market strategy and planning in the hands of expert staff members at a high level. This is a blossoming-out in the broad conception of marketing as contrasted to selling only.

Thus, the marketing and sales organization has been altered to meet decentralized production supported by a high rate of business. But the recent dip in business activity brought on forced economies and a reappraisal of organization and direction of effort. A large force of highly specialized personnel is obviously costly in slack times. This suggested a degree of departure from product selling and a greater return to concentrating on the customer himself.

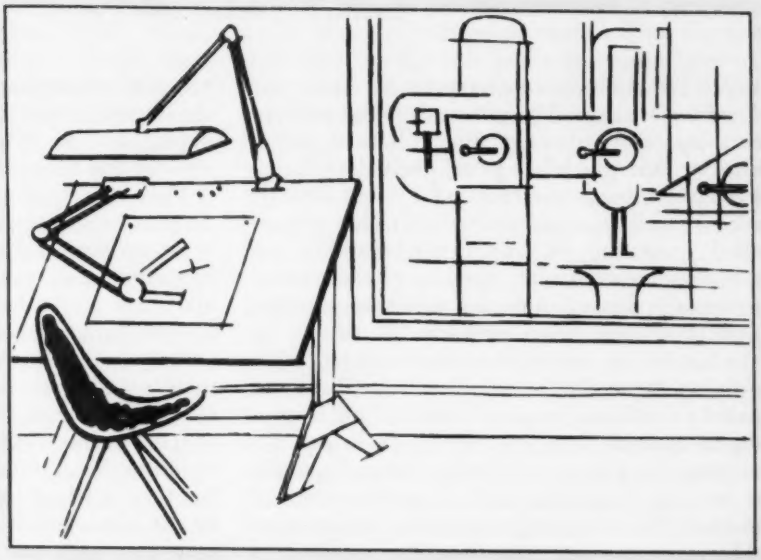
Let us cite two examples:

Last year the sales manager of one machinery concern which had increased its product line by development and mergers had a headquarters manager and field salesmen who were highly specialized. Sales volume declined far out of proportion to sales expense. The sales manager was forced to cut down his personnel and combine products under four heads and four classes of sales engineers. He had suffered from "specialitis"—product consciousness had outbalanced customer consciousness. He found that his men were so intent upon the equipment sold that they neglected the all-important prospect and customer. Clients complained that sales engineers who called on them seemed more interested in what they were selling than in them.

Another machinery-builder sales manager had gone all-out in modernizing his headquarters marketing department before the business dip. High-salaried men had been assigned to separate functions—product determination, market research, sales promotion, selling, office administration, servicing, and training. The utmost was sought in diversified effort to obtain efficiency. But "specialization" boomeranged, and prompt steps had to be taken to cut down personnel and combine responsibilities. Several other instances could be cited which support the potential dangers of over-organization and over-specialization.

One thing that we can learn from a period of depressed buying is the importance of flexibility in the marketing and sales organization. Another that we may overlook is the effect on the man himself when we carry organization and specialization too far. Too often we meet a man who is highly expert in one skill and completely helpless in others that are equally important.

MACHINERY'S Reference Section



WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

PART 6—HEAT-TREATING

March 1959

What the designer should know about production—Part 6

HEAT-TREATING

ROBERT E. MORKEN
Staff Plant Engineering Office
Chrysler Corporation, Detroit, Mich.

HEAT-TREATING encompasses the many applications of thermal processes to metal parts for the purpose of enhancing their physical properties. For example, castings are heated uniformly to temperatures in the range of 1300 to 1500 degrees F. and then slowly cooled. This process, called annealing, improves machinability and stabilizes the molecular structure of the castings to minimize distortion during subsequent cutting operations. Forgings are similarly treated.

In hardening, medium carbon steel parts in a finish-machined or semifinished condition are heated to within a range of 1400 to 1600 degrees F. and quenched in oil, water, or brine. The temperature of heating and the choice of quenching solution depend on the alloy composition of the steel. In order to prevent the formation of oxide scale, the parts are usually protected by an atmosphere consisting essentially of carbon monoxide, hydrogen, and nitrogen during the heating cycle. This practice results in what is called "clean-hardening."

The hardening of steel is accompanied by proportional increases in its tensile strength and the yield point. There also results, however, a sharp decrease in ductility, which is manifest as brittleness. To decrease this brittleness, hardened steel is usually tempered or "drawn" to a lower degree of hardness. Tempering is done within the range of 375 to 1200 degrees F. according to the final physical properties desired, and, to a considerable extent, the alloy content of the steel. Tempering also serves to decrease the substantial stresses due to the thermal shock of hardening.

There is a basic relationship between physical properties and the alloying constituents. For all practical purposes, carbon can be considered the ingredient that creates hardness in steel. Various alloys are added to refine grain size, to promote toughness, to increase tempering temperatures, and to obtain other such advantages. In the automotive industry, the main purpose of adding alloying elements is to increase hardenability.

Hardenability is the quality of a steel that determines the depth of hardness in heavy sections. In other words, if heavy sections are not involved in the geometry of a part, the alloying ingredients that improve hardenability are often not necessary. Alloying ingredients are expensive, and for that reason their use should be minimized. Furthermore, all steels hardened to the same degree and depth have, for all practical purposes, the same physical properties. Hence, if the cross-sectional size is such that through-hardening results from normal practice, no amount of alloying elements will appreciably alter the final physical properties. This statement is true except for certain technical deviations concerned with specialized metallurgy. It will act, however, as a guide to prevent over-alloying.

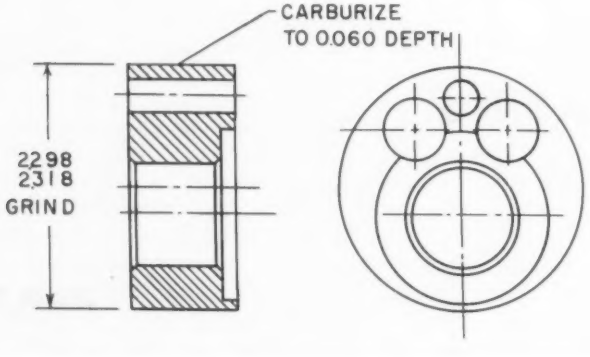


Fig. 1. Original design of a camshaft eccentric. Copper-plating was specified to prevent through-carburizing of the thin sections between the holes and outer surface.

Another heat-treating practice commonly used is casehardening. In carburizing, which is one type of casehardening, steel is heated to a range of 1600 to 1700 degrees F. in an environment having some form of carbon available. The available carbon combines with the steel progressively from the outside inward, forming a carburized layer or case. The treatment period controls the depth of penetration and subsequent quenching casehardens the parts. A high degree of hardness in the high-carbon outer surface is the result. Parts so treated have the ability to resist wear and at the same time withstand a certain amount of deflection because of the softer core. Carburized parts are usually tempered at a relatively low temperature range, 375 to 425 degrees F. This provides as much stress relief as possible while retaining a high casehardness. Carbonitriding or nicarbing, cyaniding, nitriding, induction-hardening, and flame-hardening are other methods of casehardening.

In designing parts to be heat-treated, section size should be made as uniform as possible in order to minimize distortion caused by the high stresses accompanying the thermal shock of quenching. It is desirable to avoid especially thin sections and combinations of heavy and light ones. Where it is absolutely necessary to use such combinations, generous fillets should be utilized to join the sections. Over-alloying should also be avoided, since it results in unnecessary distortion, giving rise to the need for expensive straightening operations. Improved techniques allow distortion to be virtually eliminated when part geometry is satisfactory. Design considerations for heat-treating concern not only part geometry, but material selection as well. In fact, some of the greatest potential savings lie in a prudent choice of materials. In many instances, savings made in the heat-treating process develop into even larger cost reductions in machining and related operations. Hence, a team effort by the designer and the manufacturing engineer can surely produce economies.

A camshaft eccentric that was redesigned to facilitate heat-treatment is seen in Fig. 1. As originally manufactured, this part was cut from solid bar stock on automatic screw machines. Four holes were drilled, reamed, and chamfered. The edges of the external surface were also chamfered. The part was then carburized to a depth of 0.060 inch to provide resistance to peripheral wear. Because brittleness occurred in the thin sections between the holes and outer surface, these areas first had to be copper-plated to prevent through-carburizing. This was accomplished by copper-plating the part all over and then grinding off the plating on the periphery prior to carburizing. After carburizing, the piece was ground on the periphery and a pin press-fitted into a honed hole in the part.

The redesigned part (Fig. 2) was formed in four operations on automatic presses, ground on the periphery, and then carburized to a depth of 0.020 inch. Thus, rapid press operations were substituted for a slower machining operation; copper-plating was eliminated entirely; material cost was reduced; heat-treating cycle time was reduced; and several material-handling operations were eliminated. Here, then, is a good example of how a design change in part geometry initiated to reduce heat-treating costs resulted in substantial savings in related processing.

A revision in material specification to improve heat-treatment was also effective in cutting manufacturing costs of the steering knuckles shown in Fig. 3. Formerly forged from Amola alloy steel, these parts were heat-treated to a hardness of 255 to 321 Brinell and then machined and ground to the finished dimensions. By engineering laboratory tests, the points of greatest stress were found to be in the fillet areas between the shaft and the flange. It was also determined that if these areas were hardened to 42 to 47 Rock-

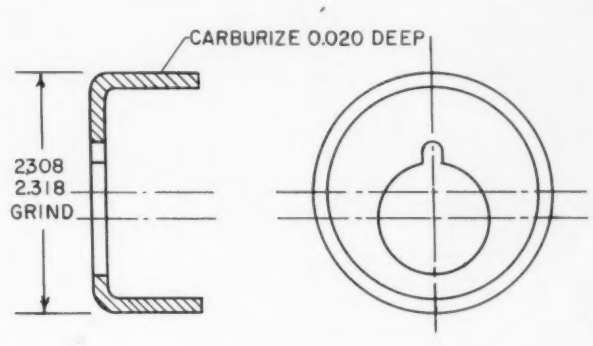


Fig. 2. Redesign of part seen in Fig. 1 eliminated the need for copper-plating prior to carburizing. This change, initiated for heat-treatment, led to other savings.

well C, plain carbon steel could be used for the part. This would not only decrease material cost but also produce a part with better fatigue properties in actual service. As a result, the material was changed to AISI C-1046 steel, and the forgings were quenched and tempered to a hardness of 228 to 269 Brinell. After machining, the parts were induction-hardened and tempered to 42 to 47 Rockwell C in the fillet areas as illustrated in Fig. 3. The greatest savings were from the change in material specifications, the plain carbon steel being less expensive than the alloyed steel formerly used. However, there were other savings. Since machining was done at a lower hardness, feeds, speeds, and tool life were increased.

In another instance, the material for rear axle-shafts was changed from an alloy steel, AISI 5160, to plain carbon steel, AISI 1033. The alloy steel, as in the case of the steering knuckles, was quenched and tempered throughout. This resulted in considerable distortion. Consequently, straightening was required. The carbon steel substituted was induction-hardened on the surface areas only, eliminating most of this problem. Again, the main economies were due to the difference of material costs. Other savings resulted through greater part uniformity, easier machining, and less straightening. Induction-hardening has been found handy for in-line production since the equipment is compact and heat radiation is held to a minimum. In addition, induction-hardening equipment can be placed in sequence in the production lines, thus eliminating material handling to and from the bulky furnace installations required for clean-hardening and carburizing. Flame-hardening in machines such as the one shown processing camshafts in Fig. 4 is another method offering similar advantages. In flame-hardening, parts are quenched in a tank integral with the machine (Fig. 5). Hardness pattern of a flame-hardened part is seen in Fig. 6.

Prudent selection of material was evident in the designing of the Torsion-Aire suspension system during a recent model change-over. In this system, coil springs were eliminated and torsion bars substituted in the front suspension. The rear of the torsion bar is attached to the frame by the part shown in Fig. 7.

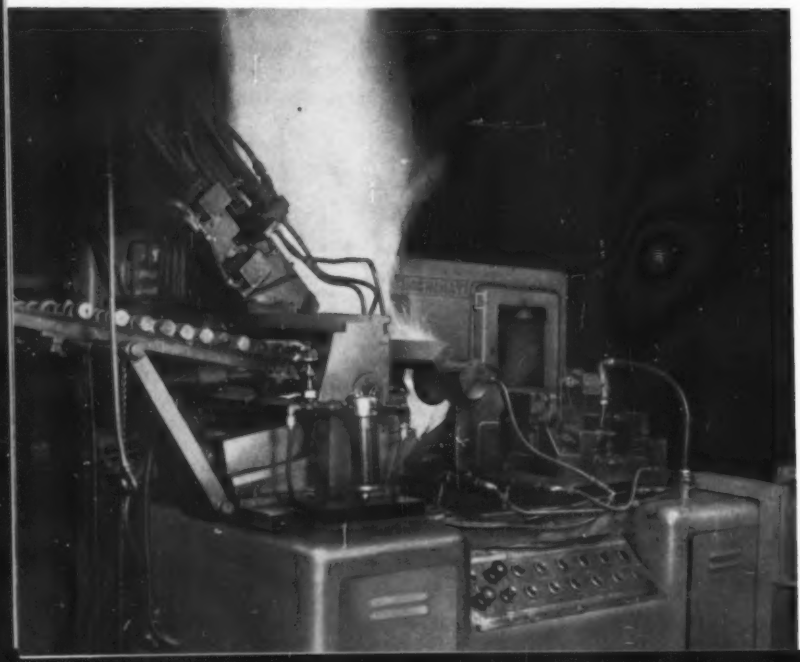


Fig. 3. (Above) Substitution of a plain carbon steel for an alloy steel simplified heat-treatment of these steering-knuckle forgings. Induction-hardening of the shaded areas at the flange replaced through-hardening.

Fig. 4. (Left) Flame-hardening equipment can be conveniently installed in the production line. Parts seen being processed are camshafts.

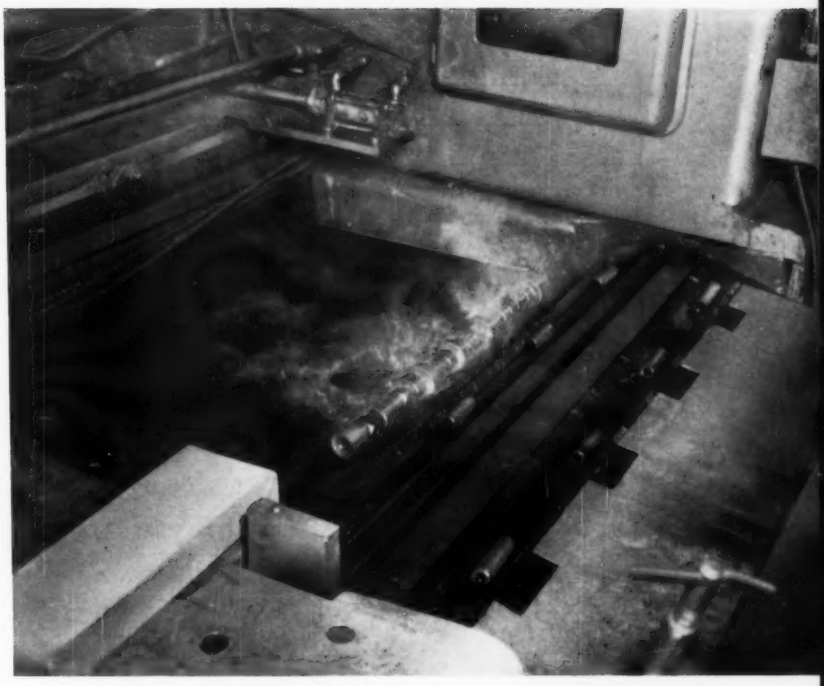


Fig. 5. (Right) Here, a camshaft of the type shown being heat-treated in Fig. 4 emerges on a conveyor from a quenching tank integral with the flame-hardening machine.

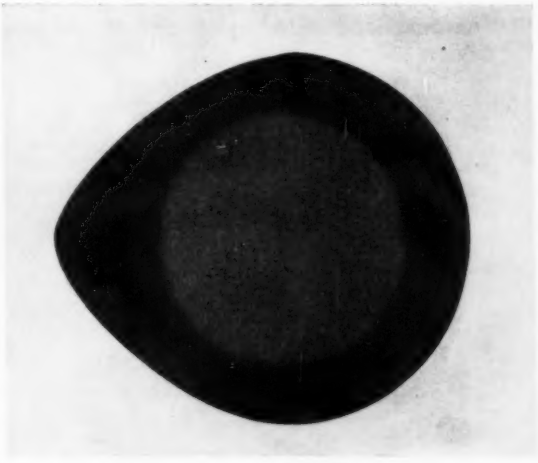
Fig. 6. (Below) Hardness pattern of the cross-section of a flame-hardened camshaft. The depth of heat-treatment is indicated by dark area.

Seamless tubing was originally specified for the cylindrical section of this part, and the hexagonal portion of the internal surface was to be induction-hardened. The extremely short available lead time, however, prevented the acquisition of induction equipment. This resulted in a change to hardening in a molten salt bath. Also, since the cost of seamless tubing is high in comparison to other available materials, a search for a substitute was begun. It was soon found that a quite accurately sized forging, pierced to eliminate at least one drilling operation, could be furnished. The part was manufactured in this manner and completed by welding on two stamped brackets, as shown in Fig. 7.

However, even as these parts were made, a further redesign was under test. In this redesign, the entire part, including the bracket, was to be made as a pearlitic malleable casting. The pearlitic treatment, which would be done by the supplier, can be controlled to provide the proper hardness range, 25 to 30 Rockwell C, thus eliminating the heat-treatment in the company's plant. The graphite contained in the pearlitic malleable material provided sufficient additional lubrication to allow successful broaching of the hexagonal section at this hardness. Broaching of the forging under the same conditions would lead to a short tool life.

An inner hub of a torque converter is illustrated in Fig. 8. The periphery of this hub acts as the inner race for a free-wheeling clutch, and must, therefore, withstand wear and severe compressive stresses. Originally, the part was to be made of AISI C-4028 steel and carburized to a depth of 0.060 inch on the periphery to obtain the required properties. Considerable distortion occurred in this heat-treatment, making it necessary to broach the internal splines to size after carburizing. Since the material when carburized was too hard to broach, it was found necessary to protect the splines by copper-plating them before carburizing. This, of course, was expensive.

To reduce costs, the material was changed to



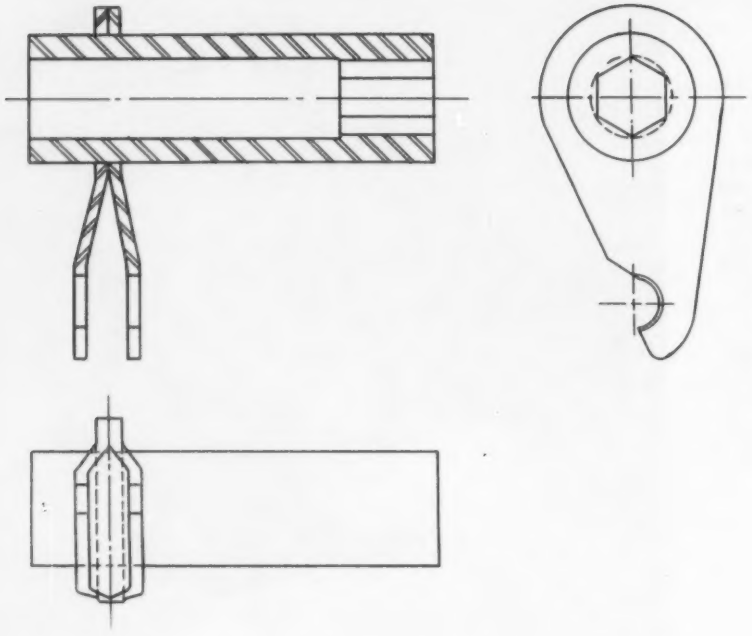


Fig. 7. Seamless tubing was originally specified for this part. The design was changed to an accurately sized forging, hardened in a molten salt bath. Brackets are stamped and welded.

AISI 1060, which is capable of being flame- or induction-hardened on the outer surface without carburizing. The hub was finally processed on flame-hardening machines, which are located in sequence in the production line. Thus, this material and method change accomplished a considerable piece-cost reduction, as well as savings in material handling.

An entirely different approach concerning choice of materials involved the rear oil-pump gear in the "Torque Flight" transmission. As originally designed, this part was to be machined from a steel forging and, subsequently, induction-hardened. A very intricate, automatic machining line was installed to make it. Later, it was found that an injection-molded nylon gear would perform much better than the specified steel gear. Consequently, the expensive machining line, which had been in operation for a period of less than a year, became obsolete. Of course, the savings obtained were sufficient to warrant the change-over in material. Had it been known that the nylon gear was satisfactory at the inception of the Torque Flight program, considerable economy in equipment cost could have been realized.

These are but a few examples showing how the expense of manufacturing processes has been reduced by means of design and material changes to improve heat-treatment. The potential savings are great. Nearly every part manufactured has possibilities of redesign for cost reduction.

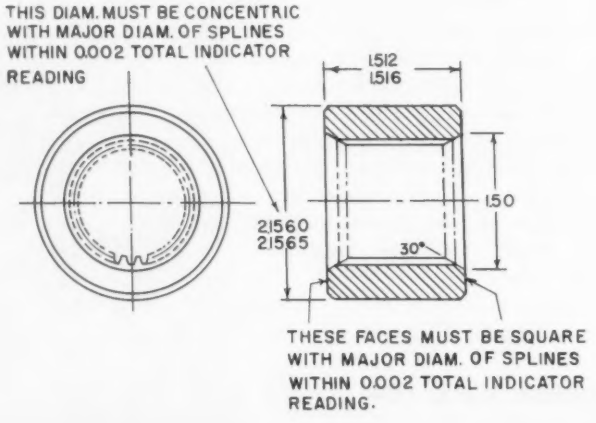

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Fig. 8. Flame-hardening of this part, an inner hub for a torque converter, eliminated the need for copper-plating of the internal spline teeth and reduced handling cost.

Castings Design Conference Held by Malleable Founders Society

A Castings Design Conference was a feature of the Semi-Annual Meeting of the Malleable Founders Society, held recently in Cleveland, Ohio. Engineers from the Central Foundry Division, General Motors Corporation, Saginaw, Mich., presented seven technical papers giving factual data helpful in the engineering of better castings at lower cost, and leading to a better understanding of modern foundry techniques.

George A. Hach, product-development engineer at Central Foundry, gave a brief resume of basic foundry terms, types of equipment employed, cost-estimating techniques, and methods of procuring and sampling pattern equipment prior to production. The use of cobalt 60 to improve casting techniques and inspection means was described by Donald F. Richter, superintendent of the experimental and development department. Radiography by means of cobalt 60 has drastically reduced the time required to inspect castings, since it does not demand destruction of the part. It gives positive location of any defects that might either be missed or eliminated by breaking or cutting. This technique also provides a means of determining the correct safety factor in gating to insure internal soundness.

"Fundamentals of Good Casting Design" was the title of the paper read by John L. Flitz, product-development engineer. Mr. Flitz stressed the importance of close cooperation between the designer and the foundryman, and determination of the parting line, Fig. 1. For high-production molding techniques, it is desirable to place the gate and feeder at the parting line and cores should be combined or eliminated if possible.

Molding and handling costs can often be reduced by combining more than one finished part into a single casting. For example, a neutral clutch piston and a rear brake-drum for an automatic transmission can be combined in one casting, as seen at the left in Fig. 2. This results in fewer chucking operations. Also, the distortion due to chucking pressures on the rear brake-drum will be minimized because this part can be machined while the casting is chucked on the neutral clutch piston. These parts are separated during the machining operations. At the right is a single casting of two different, gray-iron stator-blade carriers.

Care must be exercized in deciding whether to specify cored holes or drilled holes in castings. In general, it is often cheaper to core the larger holes if an appreciable amount of metal can be saved, or if machining operations can be speeded up or eliminated. It is usually more expensive to core the smaller holes unless an unusually large amount of machining expense can be saved.

In discussing when to use shell-molded castings, C. Dale Evans, product-development engineer, pointed out that a part made as a shell casting costs more than a part made in green sand. However, the reduced weight and the re-

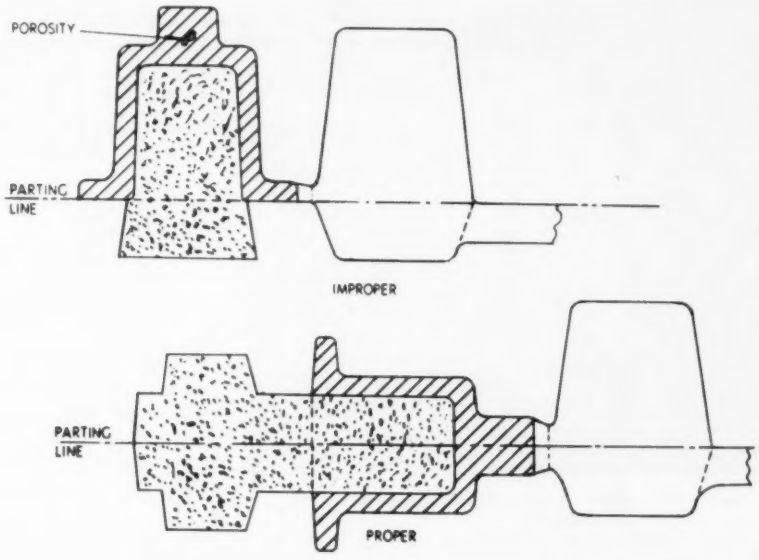


Fig. 1. Determination of the parting line is an important consideration of proper casting design. Porosity in casting shown at top was eliminated by parting in other plane, as seen at bottom.

Tolerances on Malleable and Gray-Iron Castings Made in Green-Sand and Shell Molds

Size of Casting, Inches	Tolerance, Plus or Minus, Inch	
	Green-Sand Mold	Shell Mold*
0 to 1	0.023	0.006
1 to 2	0.030	0.012
2 to 3	0.030	0.018
3 to 8	0.045	0.030
8 to 12	0.060	0.041

* Tolerances are based on dimensions that are on the same side of the parting line. When applied to dimensions across parting line, add 0.004 inch to values listed.

duced amount of required machining of the shell-mold casting can result in savings sufficient to offset the higher cost of the shell-molding materials. Dimensional tolerances and surface finishes obtainable in making parts by the shell process eliminate, in many cases, the need for machining on all except wear and contact surfaces. However, each part must be analyzed to determine which process is cheaper.

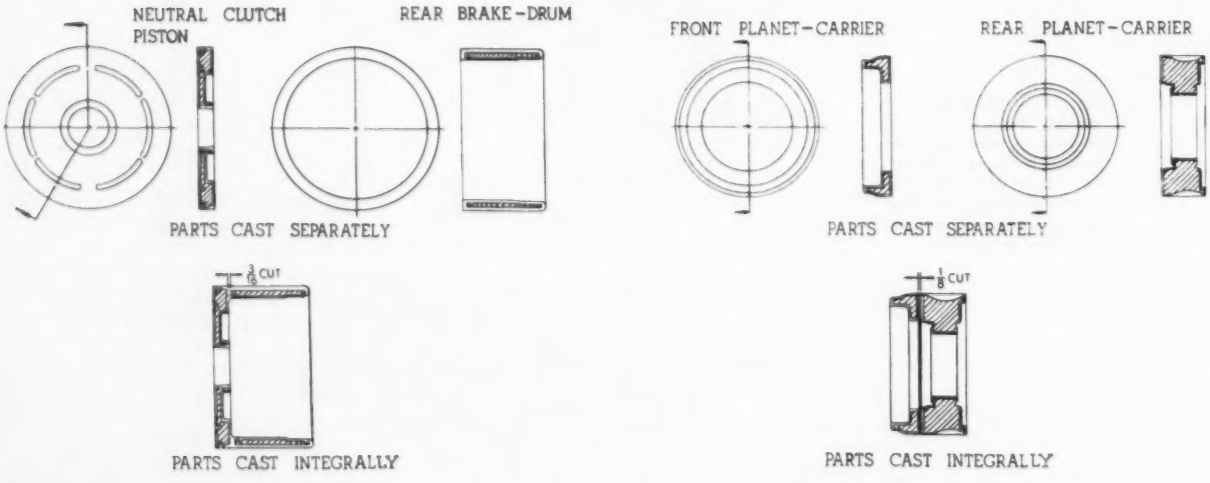
Carl F. Joseph, technical director of the Central Foundry Division, discussed factors to be considered in selecting the best iron for the job. Malleable iron is employed extensively because of its high machinability rating combined with its good physical properties. Malleable-iron parts for automobiles include hubs, differential cases and carriers, steering-gear housings, bearing caps, rear-axle housings, shifter forks, pulleys, brackets, and supports. The possible future use of cast connecting-rods was mentioned by James H. Smith, general manager of the Division.

Harold G. Sieggren, chief engineer, stated that dimensional tolerances are an important, yet controversial, subject when applied to castings. The accompanying table lists the tolerances considered practical at the Central Foundry Division. In general, these tolerances can be held on malleable iron, Armasteel (a pearlitic malleable iron produced by the Division), and gray-iron castings made in green-sand and shell molds. The tolerances shown for shell castings, however, are based on dimensions that are on the same side of the parting line. When applied to dimensions across the parting line, 0.004 inch is added to these values.

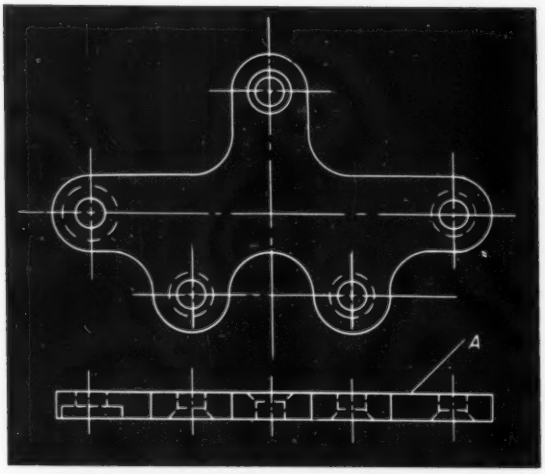
In discussing the use of stress analysis to determine and improve the mechanical strength of castings, Louis H. Ravitch, stress analyst, described the brittle-lacquer and strain-gage methods. In designing any product, material should be kept away from the neutral axis for maximum strength, plates should be kept in tension and ribs in compression wherever possible, and smoothly tapered sections should be used to eliminate high stress concentrations. For sound castings, sharp corners and abrupt section changes at adjoining sections should be eliminated by employing fillets and blending radii.

In a statement by Richard W. Crannell, president, Malleable Founders Society, and president, Lehigh Foundries Co., Easton, Pa., it was predicted that the malleable-iron industry would have an increase in sales of at least 18 per cent in 1959 over 1958. Lowell D. Ryan, executive vice-president of the Society, stated that 75 per cent of the member companies will be investing in capital improvements during 1959. Anticipated capital expenditures by these companies will exceed six million dollars. Much of this money is allocated for increasing facilities for the production of pearlitic malleable iron—which has increased 480 per cent in the past ten years.

Fig. 2. Examples of combining two different parts into a single casting to reduce molding and handling costs. The parts are separated during the machining of the castings.



SHOP KINKS



Deburring can be minimized by drilling this part in a jig that holds side (A) upward.

Drill Jigs Designed for Minimum Deburring

C. ANDREWS, Dayton, Ohio

Deburring of a work-piece having a number of countersunk or counterbored holes can sometimes be greatly reduced by giving some consideration to the design of the drill jig used in producing these holes. If at all possible, the drill jig should be made to hold the part with the side having the countersunk and counterbored holes at the bottom. In this way, the burrs formed by the drill are removed in the counterboring and countersinking operations, and deburring costs are reduced to a minimum. As an example, the work-piece shown in the accompanying illustration should be drilled in a jig with side *A* up.

Simple Height Gage

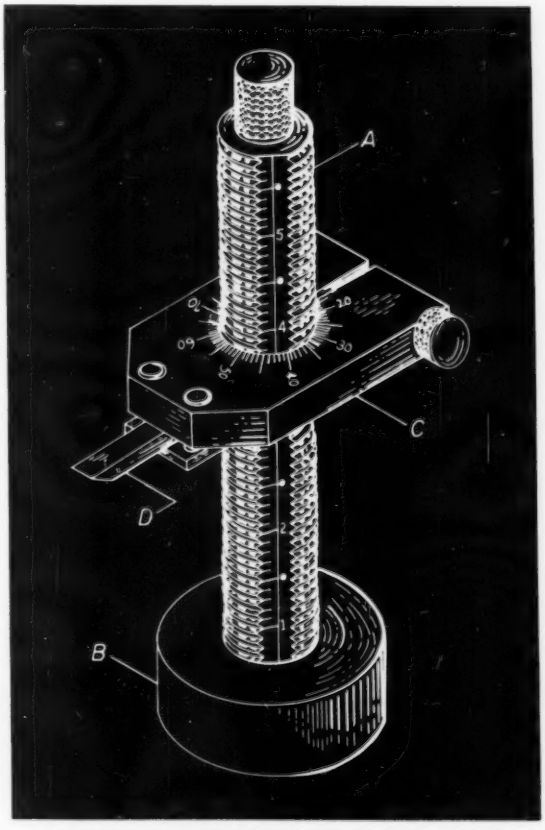
CLINT MCLAUGHLIN, Rockaway, N. Y.

A small but handy screw type height gage is here illustrated. Of simple construction, the device is quickly and easily set and can be readily clamped to maintain any height adjustment.

Essentially, the height gage consists of a threaded column *A*, a cylindrical base *B*, a measuring head *C* and a scriber *D*. The column is turned for a press fit in the base, and a short length at the top is turned and knurled. This provides a means of rapidly rotating the column for quick adjustment of the measuring head.

For convenience in calibration, the column is provided with 10 threads per inch. A flat is machined for the full height of the column and an index line is scribed down the center of this flat. Short horizontal graduations are cut in line with the root of each thread. As illustrated, these graduations which are 0.100 inches apart are marked in inches and half-inches. In addition, the measuring head is calibrated with 100 radial divisions, each representing 0.001 inch.

Measuring head *C* is internally threaded to fit the column and is slotted through at the back. A knurled head screw provides a means of clamping the measuring head on the column when



Handy screw type height gage of simple construction.

setting the height gage. Two screws and a clamping bar secure the hardened scriber *D* to the lower face of the measuring head.

The accuracy of this gage depends on the precision of the threaded column. Although the thread can be ground if desired, a number of these height gages, produced with lathe-cut threads, have been found accurate to 0.001 inch in use. In the illustration, the height gage is set at 3.742 inches.

Special Tip Automates Soldering Job

RICHARD MINSER, Cleveland, Ohio

When an ordinary electric soldering iron was fitted with a special tip, it speeded what otherwise would have been a tedious hand operation. The job, shown in the upper part of View X of the accompanying illustration, consisted of soldering a short piece of L-shaped copper wire to the center of a brass disc. Previously, a hole to receive the wire was drilled part way through the disc. Several thousand assemblies were involved.

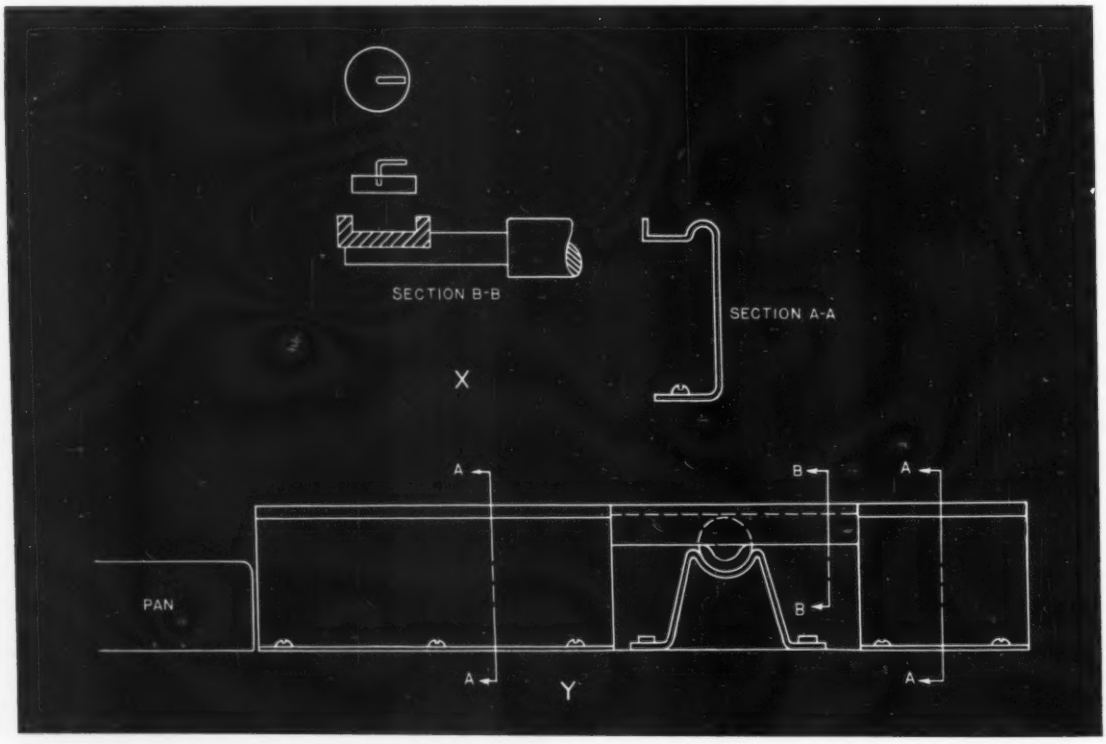
The new tip for the iron, seen beneath the work, was made from a section of copper bar. A channel slightly wider than the disc diameter was milled on top. This section was brazed to a step cut in the end of the tip. A stand was then made to support the iron horizontally, and two tracks were bent from sheet metal and set up to provide extensions of the channel in the tip, View Y.

After the iron was brought to heat, the wire ends were dipped in a proprietary mixture of solder and powdered flux and inserted in the discs. The assemblies were next placed on the sheet-metal track leading to the iron. As each subsequent wire and disc were assembled, those on the track were pushed across the face of the iron, where the solder melted, then onto the other track, where they cooled, and finally into a pan at the rear.

Total tooling cost came to about twenty dollars. The run, nearly 15,000 assemblies, was completed in less than two shifts.

° ° °

Average use of aluminum in each passenger car made in the United States has climbed from 35.2 pounds in 1956 to 40.5 pounds in 1957, and to 47.3 pounds in 1958. The estimated usage per car for 1959 is 51.5 pounds.



The wire is soldered to the disc as the assembly is pushed across the groove in the copper section forming the tip of the soldering iron.

A corner in the Oakite laboratories where chemists develop and test many different types of cleaning compounds.

Fifty Years of Scientific Cleaning

CLEANING PROCESSES a half century ago, when the Oakley Chemical Co. was founded, were based on saponification, or the conversion of the soiling medium into water-soluble soaps. Animal and vegetable fats, the major components of the soiling mediums of that period, responded readily to saponification, and cleaning was not of critical importance. However, great strides were being made in food processing and metal finishing, and cleaning was rapidly becoming important. Also, with the development of the petroleum industry, "soils" which could not be saponified were presenting problems.

Emulsification—loosening the bonds between the work or material surface and the soil, and suspending the soil in solution—was the answer. That was the peculiar ability of the company's first product, Oakite. The company recognized that there was no universal cleaner, however, and soon other products were added to meet the demands of industry. Research continued at an ever-increasing pace, spurred on by new metals, new products, new methods of processing, and the new soils they created, as well as by the increasing awareness of cleaning importance.

As the significance of cleaning as a sanitation, production, and maintenance operation became more widely recognized and the need and demand for Oakite know-how increased, the service organization grew, and other detergents of varying characteristics were added to the original product. By 1926, the product name had become so well known that it was considered advantageous to associate it directly with the company name. Accordingly, in that year, the Oakley Chemical Co. became Oakite Products, Inc., and a stock reorganization plan was instituted to make it employe-owned. For years the majority of the company's stock has been owned outright by employes actively engaged in the day-to-day operation of the company.

Cleaning compounds and chemical specialties number about 150, ranging from pickle-control solutions for acid baths in steel processing, to phosphate coatings for metals and compounds, to decontamination of surfaces subjected to radioactivity. Laboratories occupy 30,000 square feet of well-equipped space.

In a booklet which commemorates the fiftieth anniversary of the concern, cleaning methods are traced from the time of the caveman down to the present time and projected into the space age. Of special interest is reference to a description for the making of wool, as recorded on a Sumerian clay tablet dated about 2500 B.C., which includes a recommendation for cleaning the new cloth, employing a mixture of oil and potash. The potash was to be obtained by burning certain grasses rich in potassium carbonates. The resultant mixture was a forerunner of the combinations used by the Romans for washing their togas. These luxury-loving people used a variety of washing agents, including lye (made by leaching wood ashes with water or by burning seaweed), earths, clays, pumice, and other ingredients.

The booklet finally discusses the complex cleaning problems of today and refers to the future possibility of having to remove cosmic dust from the vehicles of outer space travel.

LATEST DEVELOPMENTS

Machine tools, unit mechanisms, machine parts, and

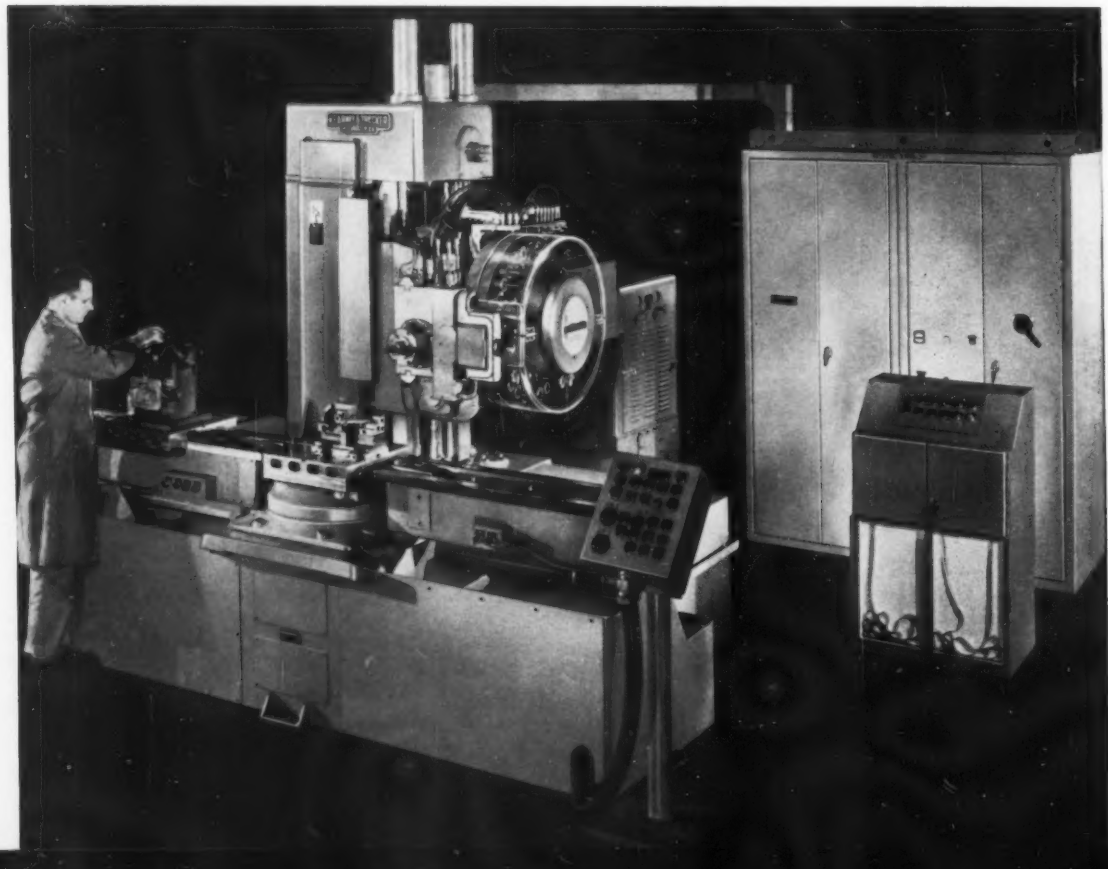
Milwaukee-Matic Tape-Controlled Machine for Small-Lot Manufacturers

A versatile, automatic tool-changing machine that makes flexible automation economically feasible for small-lot manufacturers has been developed by the Kearney & Trecker Corporation, Milwaukee, Wis. It has General Electric program controls. This tape-controlled KTNC Milwaukee-Matic combination machine, Fig. 1, performs milling, drilling, reaming, tapping, and boring operations and is designed to bridge the gap between job shop mechanization and automation. It is claimed that by reducing setup time, production time, labor costs, and inventory, this machine can pay for itself in one to three years when used by any manufacturer producing goods in small or medium lots.

The machine shown in Fig. 1 receives all its operational commands from the General Electric program controls (right). The work-piece setup does not interfere with the machining operation. At the same time the unit is completing a part, the operator is securing another part, entirely different, to a pallet parked on the shuttle mechanism. After the first work-piece is completely machined, it is automatically transferred, under tape control, to the right. Simultaneously, the pallet at the left is moved into position on the index-table. The other tape then takes over and, while this part is being machined, the part on the right pallet is replaced. Should an entirely different part be scheduled, the tape is replaced also. If succeeding operations require tools other than those already in the rotary tool magazine, they can be changed in a matter of minutes.

As many as thirty-one different tools can be loaded into the machine at one time—thirty in the specially designed revolving tool-storage drum and one in the spindle. There are thirty-one different combinations of thirty-one tools, ranging in size up to 2 5/8 inches in diameter, that can be utilized by the machine, making a total of 961 tools.

Fig. 1. Milwaukee-Matic with General Electric program control announced by Kearney & Trecker Corporation



IN SHOP EQUIPMENT

material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

To make tool changes, a transfer arm automatically pivots out from its position beside the drum, as shown in Fig. 2, simultaneously removes the tool from the spindle and a new tool from the tool-storage drum, rotates (see Fig. 3), simultaneously inserts the new tool in the spindle and the other in the drum, and returns to its normal position. Less than nine seconds are required for tool changes.

The General Electric control system makes the tool selection and directs the work-piece transfer. If the programmed tool has not been loaded into the drum by the operator, the drum will continue to revolve until it is stopped and the proper tool is inserted. The tools carry a binary code and can be placed at any position within the drum regardless of the sequence in which they are to be used. Mechanical "fingers," seen just in back of the space from which a tool has been removed from the drum, Fig. 3, feel the tools and signal the control to stop the drum when the desired tool is in position to be removed by the transfer arm.

In operation, the work-table is automatically indexed to present work-piece surfaces to the spindle. The spindle moves longitudinally, vertically, and to depth. Feed rates range from 1 to 99 inches per minute and are selected in increments of 1 inch per minute. Spindle speeds from 100 to 4000 rpm are selected in increments of 10 rpm.

As the spindle is used for tapping, a complete reversal requires 0.1 second at 100 rpm and 0.4 second at 400 rpm. Acceleration of the feed drives up to 100 inches per minute is accomplished in 0.05 second. Where feed rates are not specified, positioning is done at 200 inches per minute.

The numerical-control system was developed specifically for this application by General Electric's Specialty Control Department, Waynesboro, Va. The control system makes the entire machine automatic. It not only directs positioning of the work-table and three-axis spindle, it also controls tool selection, tool changing, spindle speed, feed rate, and auxiliary functions such as turning coolant on and off, as well as operating the shuttle work pallet between the index-table and load and unload stations.

Slope and arc cutting can also be performed by the machine. This feature does not introduce control complexity, nor difficult tape-preparation problems requiring computers.

The machine will perform circular cutting of radii from 0.1 to 9.9 inches in radius increments of 0.1 inch. The maximum error on arc milling is plus or minus 2 per cent of arc length. Maximum speed of arc and slope cutting is 30 inches per minute, and for radii, between 0.5 and 9.9 inches. According to design engineers the control permits users to mill clearances, "walk" around joint faces, and perform similar jobs where high accuracy is not required.

The first step in processing a part for the machine consists of listing dimensions, machining sequences, and auxiliary functions on a simplified planning sheet. The engineer or technician takes the necessary information from an ordinary blueprint. Then a typist, using a standard typewriter-tape punch, transcribes the planning-

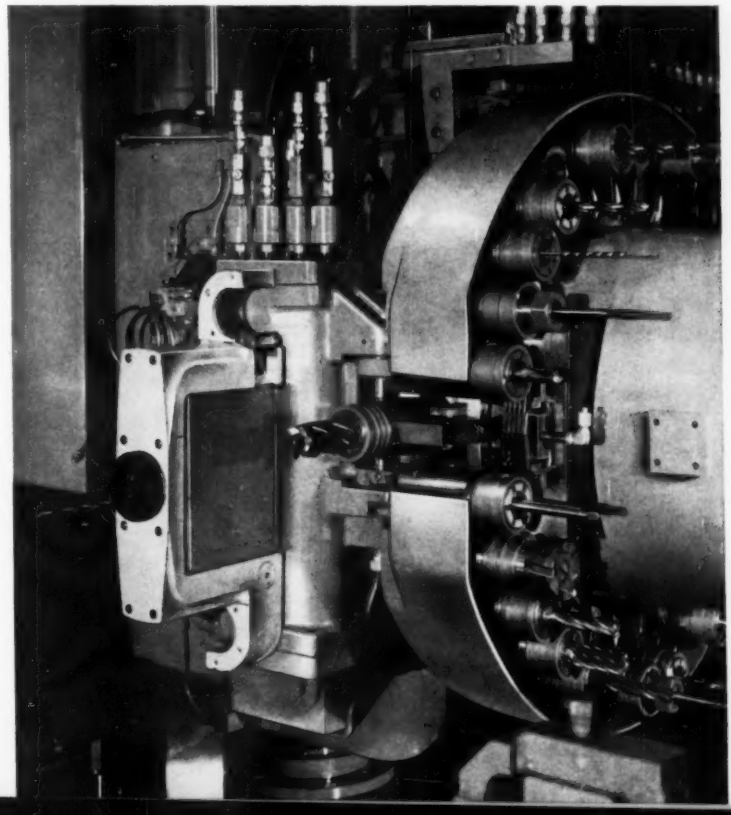


Fig. 2. Close-up of tool-change arm and selected tool in the first step of change-over on machine illustrated in Fig. 1

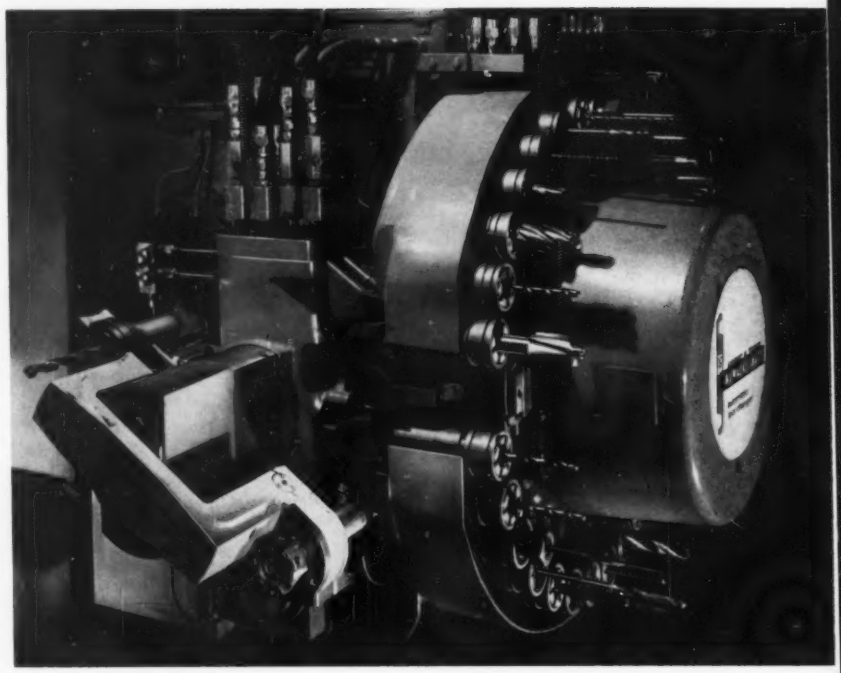


Fig. 3. Tool-change arm shown in Fig. 2 in process of transferring selected tool to machine spindle and returning previously used tool to drum

sheet data. To provide a visual check of the accuracy of the transcription, corresponding numbers are typed on the planning sheet at the same time as they are being punched in the 1-inch, eight-channel input tape. After checking the typed numbers against those originally placed on the planning sheet, the tape is ready for use. If corrections are necessary, tapes can be readily duplicated with only the changed data requiring attention.

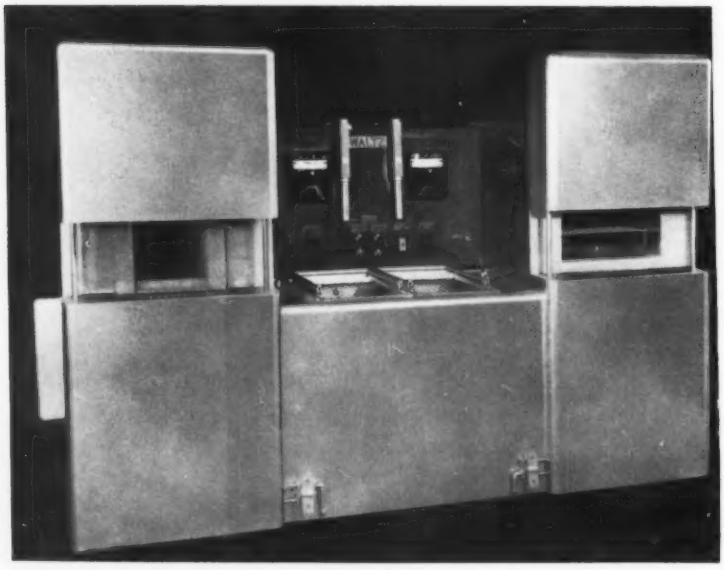
At the machine the tape is read by a standard mechanical tape reader. The control system is equipped with dual storage registers to eliminate any loss of machine time while the tape is being read. Pushing a button is all that is required to put the versatile combination machine into operation. Once started, it will continue to function automatically until the programmed job is completed. While the machine is in operation, the operator is free to prepare the next work-piece for production and to select the necessary tools required if a new part is to be machined. This makes possible a complete change-over in minimum time.

Circle Item 565 on postcard, page 173

Automatic Heat-Treating Furnace

An accurate, automatic temperature control has been developed by the Waltz Furnace Co., Cincinnati, Ohio, for its compact heat-treating furnaces. The Model CH heat-treating furnace illustrated, for example, is equipped with electronic, automatic control instruments and electrically operated control valves. It is completely streamlined and has tight sealing on the air-operated furnace doors. It is claimed that very little skill is required to operate this furnace. Although small in size, this particular model furnace is completely engineered to heat-treat all types of water- or oil-hardening steel.

The furnace has a temperature range of 1000 to 2400 degrees F. The inside of the firing chamber is 12 inches wide by 10 inches high by 18 inches deep. The tempering oven has a range of 250 to 1100 degrees F., and its inside dimensions are 21 inches wide by 10 inches high by 18 inches deep. Many sizes and shapes of tools, dies, and production parts can be heated, quenched and drawn on this Model CH furnace. It can also be used for annealing, normalizing, pack-hardening, and stress relieving. The furnace is also available in an electrically heated type which is known as Model EH.



Waltz heat-treating furnace

Circle Item 566 on postcard, page 173

Automated Transfer Machine for Processing Bearing Caps

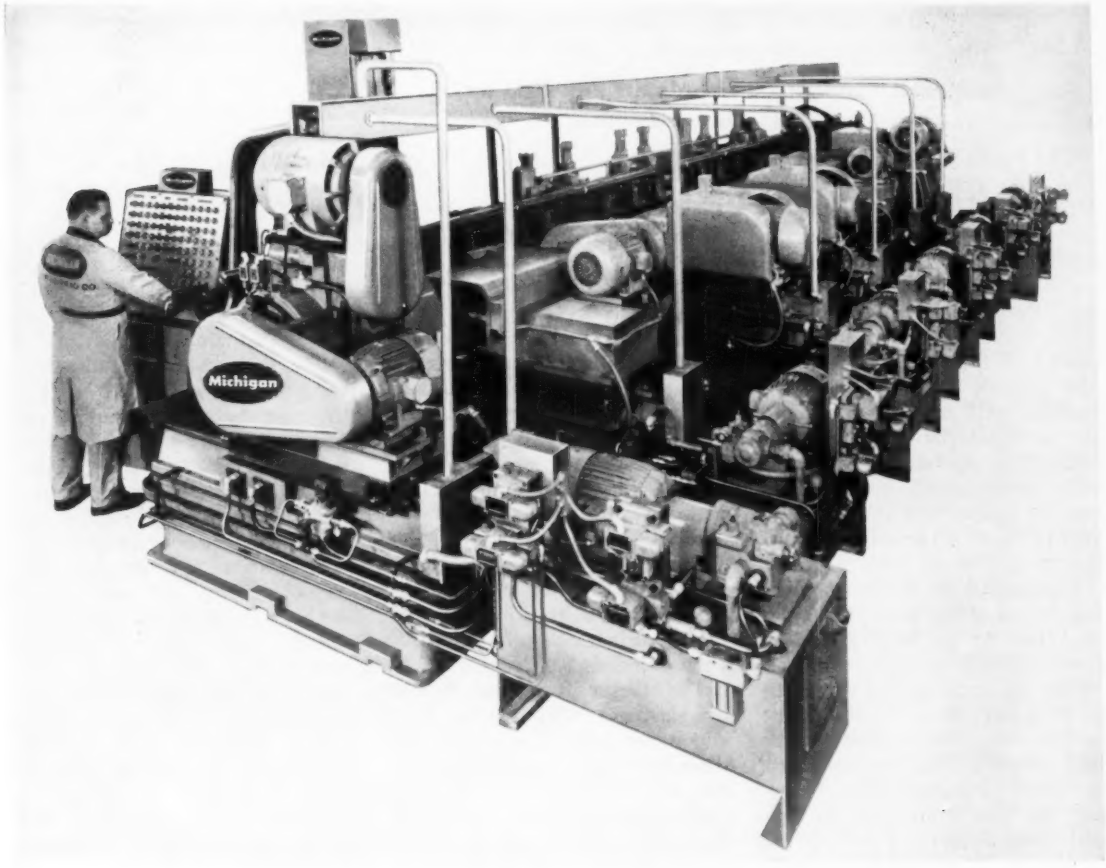
A fully automated, nineteen-station transfer machine has been designed and built by the Michigan Drill Head Co., Detroit, Mich., to produce bearing caps for one of America's outstanding automobiles. These caps are machined from castings, each of which yields five finished parts. When operating at 100 per cent efficiency the machine will handle seventy-five castings per hour.

This horizontal and vertical, in-line transfer machine is of sectionalized design, a feature which makes it possible to take care of future model changes with a minimum expenditure of both time and money for re-tooling. Each working station is designed for individual cycling to facilitate both setup and checking. As a safeguard against obsolescence, a number of idle stations have been provided for re-tooling and to take care of product change requirements, as well as the machining of entirely new products. The cast work-pieces are transferred by a hydraulically actuated, swinging bar type mechanism while the pieces are held or trapped between hardened-and-ground steel slide rails. All feed units are of the manufacturer's own standard design.

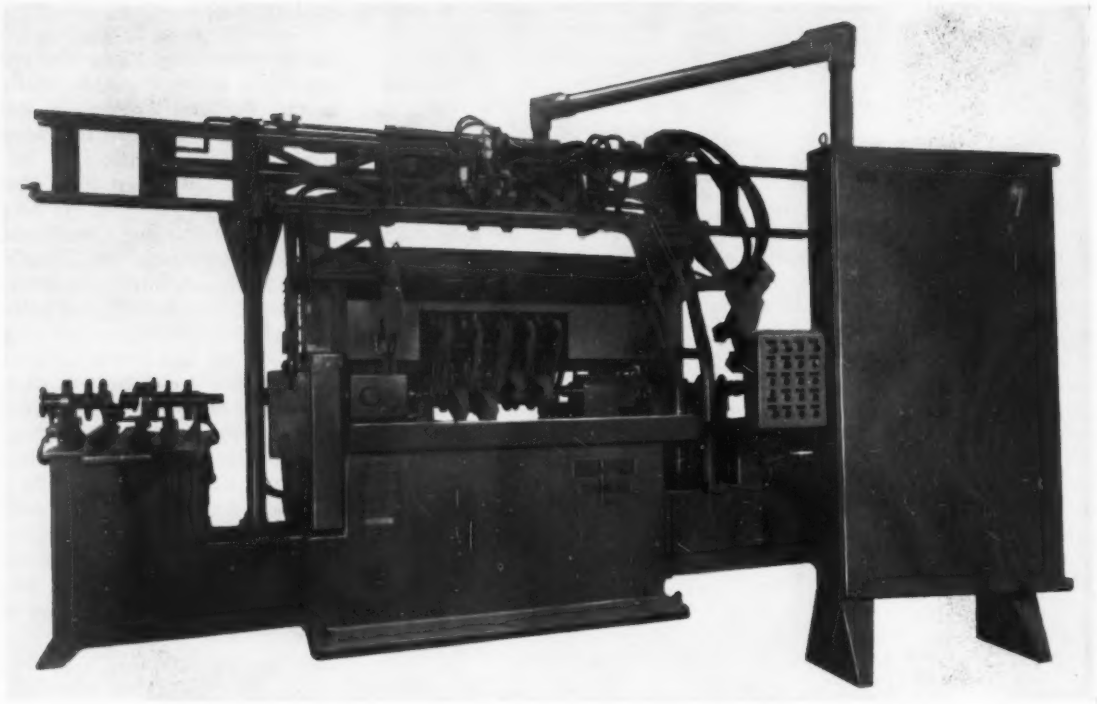
Other features of this machine are: heavy-duty planetary head for machining the oil seal at the first station; heavy-duty milling heads at the milling and sawing stations; built-in power-operated chip conveyor; and automatic lubrication throughout. All electric and hydraulic installations are built to JIC standards.

The bearing-cap castings, after undergoing a face broaching operation, are loaded automatically into the first station of the automated transfer machine. The operations performed automatically in the eighteen succeeding stations include, in the following order: planetary milling of oil-ring groove; idling in third station which is provided to take care of future tooling operations; rough-milling ends to length; idling at fifth station; drilling vertical cap holes; drilling bolt holes 1/2 inch deep and drilling two oil holes; drilling bolt holes; idling at ninth station; reaming locating holes and spot-facing the bolt holes; idling in eleventh station; inspection—probing bolt holes; milling three lock slots; milling two lock slots; idling at fifteenth station; finish-milling to length; cutting off in individual bearing-cap sections; segregating into eject chutes; and checking sides of parts for finish.

Circle Item 567 on postcard, page 173



Nineteen-station transfer machine for processing bearing caps built by Michigan Drill Head Co.



Footburt-Schraner automatic crankshaft lapping, fillet-rolling or roll-burnishing machine

Automatic Crankshaft Lapping, Fillet-Rolling or Roll-Burnishing Machine

The Foote-Burt Co., Cleveland, Ohio, has introduced a Footburt-Schraner Model SFB completely automatic machine for lapping or roll-burnishing bearing surfaces on crankshafts and for fillet-rolling stress-concentration points where there is a change in the diameter of the shaft. Attachments also provide for lapping thrust surfaces. All lapping operations are performed by coated-abrasive belts. The machine is equipped with a hydraulically operated, automatic loading and unloading device to adapt it for use with integrated production lines.

Crankshafts are fed to the loading station of the machine from a conveyor. At the loading station, the crankshaft is positioned both axially and radially. Transfer arms pick up the positioned crankshaft and the one in the machine, swing both outward, and then move past the front of the machine, bringing the new crankshaft in line with the machine and the finished crankshaft in line with the unloading station. The transfer arms then swing inward, positioning the new crankshaft between the head and tailstock and depositing the finished crankshaft on the unloading station.

The headstock drive cup then moves in to engage drive holes on the crankshaft flange. At the same time, the tailstock center engages the front end of the crankshaft. The transfer arms move out of the way and the cycle begins.

In one installation, the Model SFB machine laps all pin bearings, main bearings, and thrust faces, and roll-knurls wiper grooves on an oil-seal diameter. Production is sixty pieces per hour at 80 per cent efficiency. Resulting finish on the lapped surfaces is held to from 5 to 7 micro-inches.

The thrust faces are lapped by narrow coated-abrasive belts which are held in contact with them by spring pressure from special attachments which float on the lapping-head arms. To provide the proper lapping scratch pattern on the bearing surfaces, the headstock spindle, work, and tailstock center oscillate past the lapping heads. Therefore, the thrust-face polishing attachments float freely on the lapping-head arms to follow the work and maintain continuous contact.

Knurling is done by a hydraulically actuated auxiliary head which rises from below the work. The fillets and bearing surfaces are lapped simultaneously. Fillet-rolling is done in a separate operation to increase fatigue resistance by creation of a smooth, compressively stressed surface. Roll-burnishing is done after lapping or instead of it, to produce a smooth, slightly cold-worked surface for longer bearing life.

The Model SFB machine has a 15-inch swing and will accept work up to 36 inches long. Up to sixteen heads can be provided; each can lap a bearing and a fillet and thrust surface on each side. The machine is driven by a 10-hp motor equipped with electric clutch and brake. The hydraulic system is separate; a 3-hp motor is provided for lapping and fillet-rolling; roll-burnishing requires a 5-hp motor.

Circle Item 568 on postcard, page 173

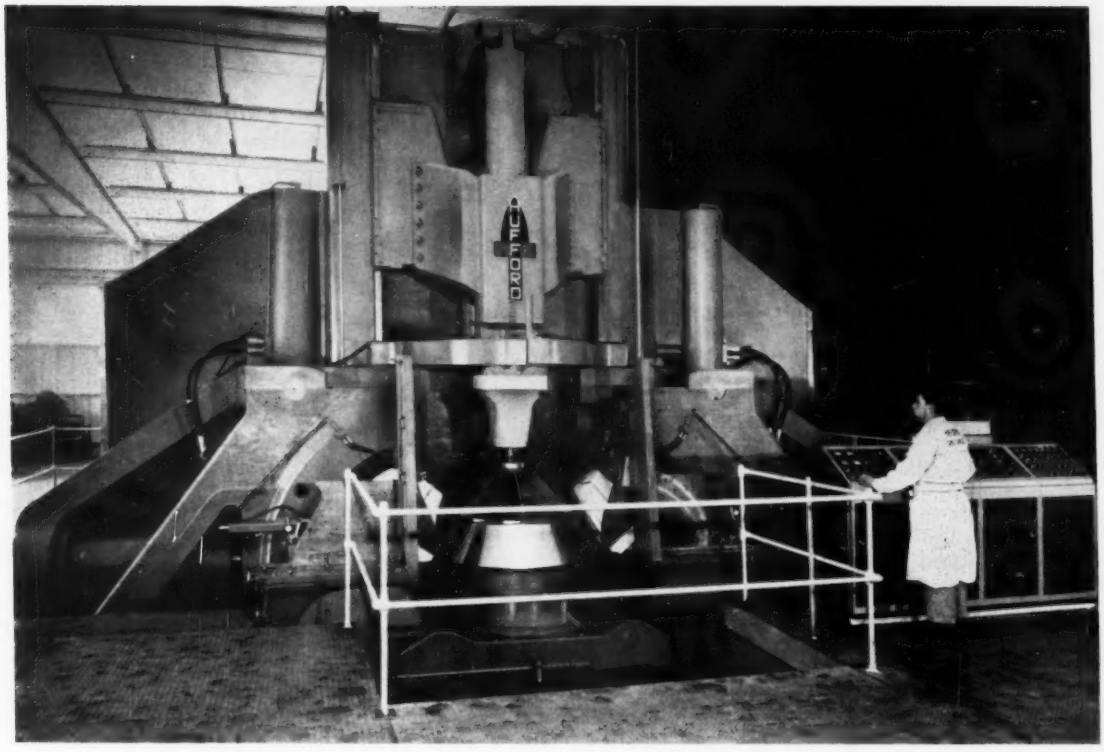


Fig. 1. Hufford "Spin Forge" of giant size developed to form stainless-steel aircraft and missile parts

Hufford Giant Size "Spin Forge" Machine

The Hufford Corporation (A Division of the Siegler Corporation), El Segundo, Calif., recently introduced a huge "Spin Forge" machine, Fig. 1, that can easily form a piece of stainless steel 1 inch thick into an aircraft or missile part. One of the great advantages obtained in forming metal parts on this machine is the spin-forge action that serves to increase the strength of the material used. In some cases the strength of the material may be increased as much as 100 per cent.

Many parts heretofore considered impossible or impractical to manufacture in one piece can now be produced on this machine. The production cycle is said to be cut by more than 50 per cent over that obtained by methods previously employed in making such items as rocket engine cases.

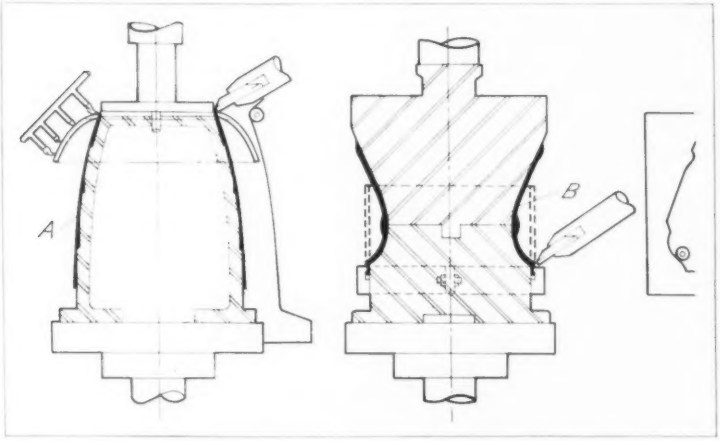


Fig. 2. (Left) Diagram showing cross-section of mandrel used on machine, Fig. 1, to spin forge part (A). (Right) Mandrel and tracer control template used in production of part (B)

The "Spin Forge" machine is capable of applying a total work force in excess of one million pounds to form parts up to 60 inches in diameter and 10 feet in height. It is 25 feet wide, 24 feet high, including its base; and weighs more than 450,000 pounds. The cross-sectional form or shape of two typical parts formed by spin forging are shown by the heavy black sections at *A* and *B*, Fig. 2.

The entire unit is designed to meet the new requirements in component size, shape, tolerances, and materials created by recent advances in aircraft and missile technology. In operation the "Spin Forge" utilizes a combination of rolling and shearing principles to produce mechanically spun "surface-of-revolution" sections such as conical, tubular, or parabolic

configurations with varied wall thicknesses. Aluminum, titanium, nickel, and molybdenum-base alloys, in addition to austenitic stainless steels, have been formed into different configurations with varying amounts of reduction.

Surface - of - revolution - shaped parts with varied contours held to a tolerance of plus or minus 0.003 inch are attained by full (100 per cent) tracer control. The tracer controls are fully transistorized and continuously synchronize and control the positions of the tool rings, both vertically and horizontally, and, in conjunction with the spindle tachometer, maintain a constant feed per revolution and a constant surface speed. Regardless of the diameter or contour of the part being worked, the speed of the slide, in inches per minute, is controlled to maintain a constant feed per revolution regardless of the spindle speed.

In operation, an electronic tracing head with a stylus traces the template. This unit is coupled to an oil-gear variable-volume pump by an electrohydraulic servo valve. This servo valve controls the output volume of the 3000-psi actuating-system pump and as a result controls the positions of the tool rings. A double-axis tracer, it controls two pump units, one for vertical and one for horizontal movement.

Circle Item 569 on postcard, page 173

Monarch Mona-Matic Lathe Equipped with Tracer-Controlled Follow-Rest

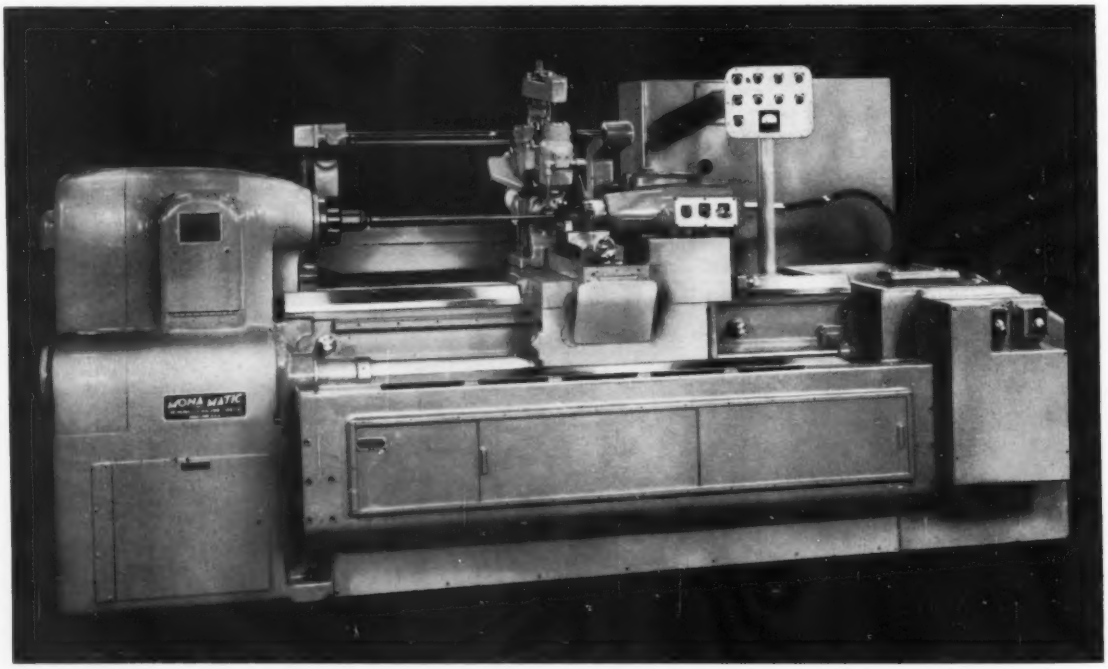
The Monarch Machine Tool Co., Sidney, Ohio, has developed a tracer-controlled follow-rest for use on its Model 21 Mona-Matic lathe. This equipment is especially designed to solve the difficult problem of turning contours on long, slender work-pieces where conventional steadyrests or follow-rests cannot be used. Tubular pieces, such as rifle and shotgun barrels, are typical examples of such work. The new equipment has anti-friction follow-rest rollers mounted above and behind the work-piece. Each roller is moved in and out by its own hydraulic cylinder which is controlled by a separate "Air-Gage Tracer." Another spring-loaded follow roller is located adjacent to and immediately following the tool.

Turning is accomplished under "Air-Gage Tracer" control, the tracer-slide being set at a 90-degree angle to the work. The template, in the form of a master work-piece, is traced by three tracer heads. The front head controls the tool while the other two heads correspond in position to the follow rollers they control.

Because some work requires two cuts, provision is made for the use of two master work-pieces—one for rough and one for finish turning. A template carrier is indexed hydraulically as required during the cycle to move the masters into and out of the tracing position. Tied in with the cycling is an automatic, two-position tool turret which indexes hydraulically. A roughing-cut tool is used during the first pass, and a finishing-cut tool during the second pass, to increase the quantity and improve the quality of the work.

Provision is made for an infinitely variable hydraulic feed up to 40 inches per minute. There is a separate feed-rate controller for the rough- and finish-feed rates which can be adjusted to suit the work and tool characteristics.

Circle Item 570 on postcard, page 173



Mona-Matic lathe equipped with tracer-controlled follow-rest for contour-turning long, slender work

Fig. 1. Elements of Stromberg Time Corporation's "Transacter" system receiving final inspection at factory prior to installation at U. S. Naval Gun Factory

Stromberg Transacter System for Processing Data

An electronic data-processing system developed for use in all mass-production industries, particularly in the automotive, aviation, and home-appliance manufacturing fields, has been announced by the Stromberg Time Corporation, subsidiary of General Time Corporation, Thomaston, Conn. The first production unit of this "Transacter" system, as it is called, has been installed at the United States Naval Gun Factory in Washington, D. C., where it will be used to feed data information to an IBM 650 computer. Its primary function will be to simplify manufacturing control.

Fig. 2. Close-up view of Transacter (right) and compiler unit (center) of system for processing industrial data announced by Stromberg Time Corporation

Fig. 1 shows elements of the Transacter system receiving final inspection at the factory. On the bench, in the foreground, are Transacter units which gather and instantly transmit information to a compiler (two in background) where it is recorded on punched tape for use in other data-processing equipment which constitutes the "electronic brains" of industry.

The close-up view, Fig. 2, shows the electronic equipment of the Transacter system which gathers information at the point where a transaction occurs and instantly transmits it to a central data-processing station. As many as sixty Transacters (at the right in the photo) located as far away as 3 miles from the center station accept data from punched cards and dials and electronically send it to the one central compiler unit (center). The compiler records this data on punched tape for storage or for transmission to tape-to-card converters, automatic typewriters or other data-processing equipment. Thus, the task of gathering and transmitting data is reduced to seconds.

Circle Item 571 on postcard, page 173

Farrel Heavy-Duty Roll Grinder

The Farrel-Birmingham Co., Inc., Ansonia, Conn., has built a Farrel grinder of the moving-wheel type equipped with a 36-inch diameter wheel. Carriage reversal is controlled by micrometer adjustment and is accurate to within 0.005 inch for grinding up to shoulders. The over-all accuracy of the machine makes it capable of producing any desired finish which can be obtained with wheels now available. Concentricities of even the larger work-pieces can be held to within 0.0002 inch.

A large-diameter body and a small-diameter tapered journal can be ground with a single setup. Because the work-piece does not have to be moved to perform these two operations, there is an important saving in time as well as an assurance of concentricity between the body and the journals. Tapers can be ground in a range up to 30 inches in length and 1 inch per foot on the diameter of the work.

With its unusually wide capacity range—diameters from 5 to 75 inches and lengths up to 12 feet between centers—this new machine is ideal for grinding many types of cylinders requiring accurate finishes. To accommodate the larger sizes of cylinders, it is provided with a gap type bed.

The headstock has infinite speed variation within a 10 to 1 range, which allows the selection of a suitable work speed for any diameter the machine can handle. The carriage and grinding wheel also have infinite speed variation through rheostat control, which permits optimum settings for any grinding conditions that may be encountered.

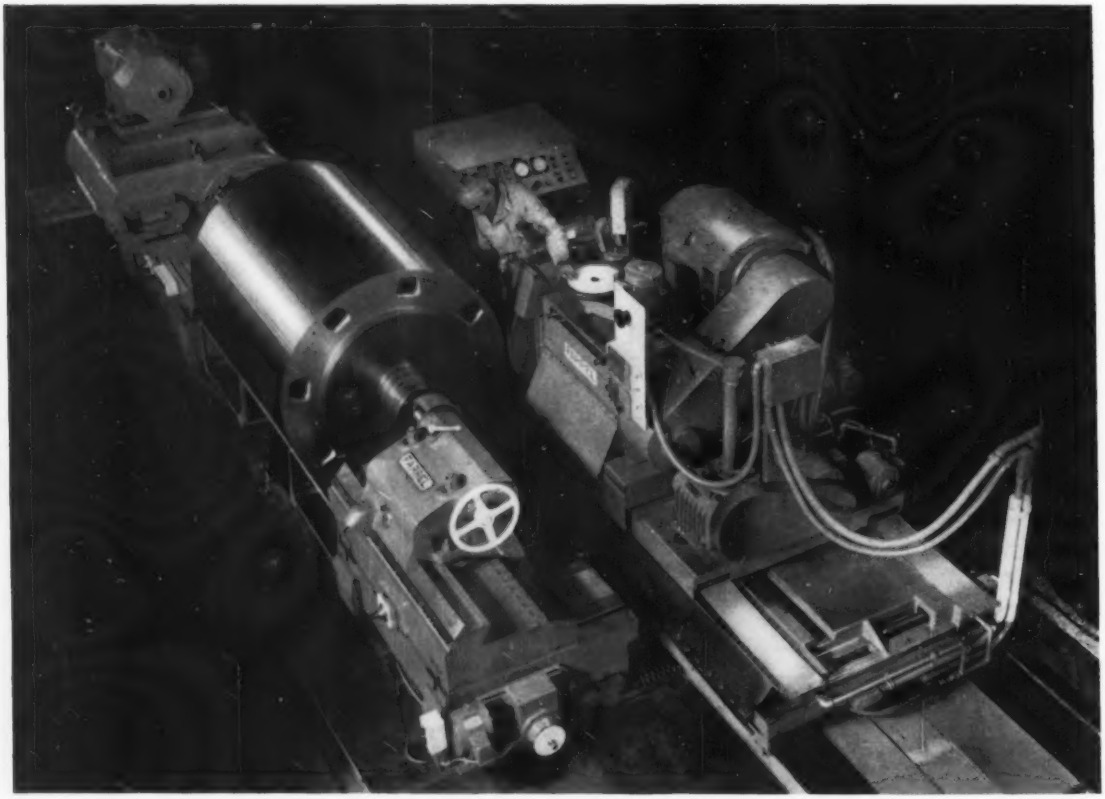
The accompanying illustration shows the Farrel cylindrical grinder installed in the Westerly, R. I., plant of the Cottrell Co., a subsidiary of Harris-Intertype Corporation, Cleveland, Ohio. The cylinder shown in the machine weighs 18,000 pounds.

Circle Item 572 on postcard, page 173

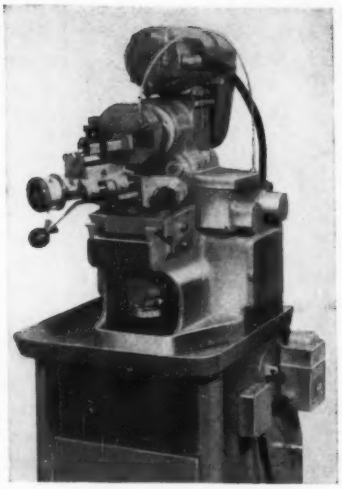
Electrode for Sheet Metal Welding

The Lincoln Electric Co., Cleveland, Ohio, has announced a Fleetweld 180, E-6011 electrode for arc-welding sheet metal and for general maintenance welding. The ability of this electrode to operate on currents as low as 50 amperes and its light slag make possible the welding of even 0.036-inch (20-gage) material without burn-through. On the other hand, when the current is increased, the arc becomes forceful and deep penetrating so that it is suitable for general repair welding. The electrode is stable on machines with open-circuit voltages as low as 45 volts. This Fleetweld 180 electrode is available in 3/32-, 1/8-, and 5/32-inch sizes.

Circle Item 573 on postcard, page 173



Heavy-duty roll grinder built by Farrel-Birmingham Co., set up for grinding impression cylinder for large printing press



De Vlieg Micropoint tool grinder

"Micropoint" Tool Grinder

A tool grinder called the "Micropoint," developed for accurate sharpening of single-point cutting tools, is announced by the De Vlieg Machine Co., Royal Oak, Mich. This is claimed to be the first machine capable of producing geometrically correct tool points ground to gage-room accuracy. It will grind single-point profiles with either cone or cylindrical relief at the radius, and can handle tools with 1-inch-square shanks.

The possibility of human error is said to have been substantially reduced by the dial-control system of this tool grinder. Direct dial settings provide a method of fast, simple, and accurate adjustment for each radius, cutting angle, offset, and clearance in exact accordance with the geometric requirements of the tool. Thus tolerances can be controlled to an even finer degree than before.

The wheel-spindle head has an adjustable reciprocating movement and the generating cycle is hand-operated.

The Micropoint system of single tool-point geometry is based on making all dimensions of the cutting edge relative to the center of the tip radius. The accurate blending of the radius into the flats of the lead and end-cutting edges provides a tool profile that results in faster, more accurate work and a finer finish.

Circle Item 574 on postcard, page 173

Vertical Press Equipped for High-Speed Precision Stamping of Rotor Laminations

A 100-ton press capable of exceptionally fast production of precision-stamped rotor laminations has been built by the Precision Welder & Flexopress Corporation, Cincinnati, Ohio. The press, Fig. 1, can be used to stamp out rotor laminations at rates exceeding 300 parts per minute—one part for each press stroke. This is said to be almost three times as fast as the production speed previously obtained.

The Precision Flexopress weighs close to half a ton. To make 300 strokes a minute its ram must travel 2 inches, come to a full stop, and reverse direction 600 times a minute. At this speed, the inertia of the ram creates an impact force of at least 100 tons. Nevertheless, the press operates so smoothly that it is not even necessary to bolt it to the floor. Much of the secret of its operating smoothness lies in the pre-loaded ball-bearing raceways on the ram. The V-type raceways require no clearance for lubrication. The ram is "locked" to operate only in the vertical plane, thus preventing sideplay. This no-float construction maintains positive alignment of punch and die. The precision attained by this construction is said to result in greatly increased die life even in this case where the dies will be called on to blank slots and holes in 0.025-inch-thick silicon steel discs.

The punch-and-repunch method used in producing the electric motor laminations is a two-step operation. First, blanks ("cookies") are stamped out of sheet or strip metal.

Fig. 1. Press built by Precision Welder & Flexopress Corporation for high-speed stamping of rotor laminations

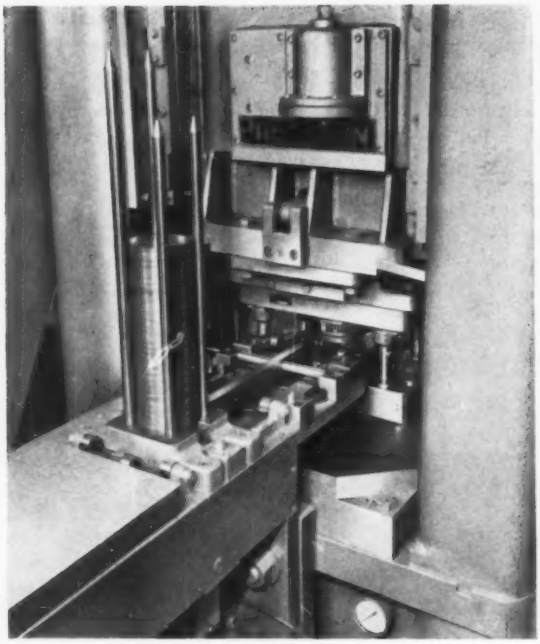


Fig. 2. Close-up of the Flexofinger blank feeder of press shown in Fig. 1 which produces one piece at each stroke

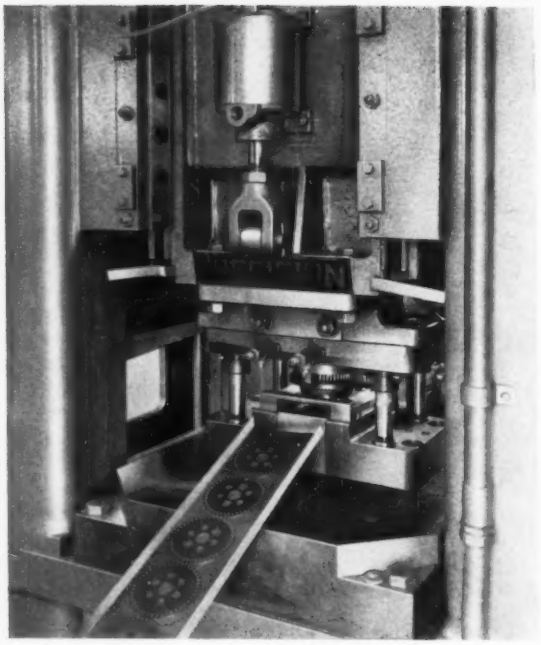


Fig. 3. Stamped laminations leaving rear of press which operates as fast as 345 strokes per minute

Then they are stacked as shown in Fig. 2 and fed individually into the die that punches the slots and holes. In spite of this double-handling, punch-and-repunch procedure, the process is said to be competitive with progressive die production of motor laminations because of the smaller presses required, the much lower die cost, and savings in material.

The feeder, Fig. 2, has been precision designed for maximum production with the press mounted in its normal vertical position. This has the advantage of providing absolute control over feeding and ejection of the work. Named the Flexofinger, this simple shuttle feed employs spring-loaded fingers (dogs) in reciprocating and stationary guides to slide the "cookies" off a stack and into a die. It is linked by a timing chain with the crankshaft of the press. The stamped laminations are shown leaving the press in Fig. 3.

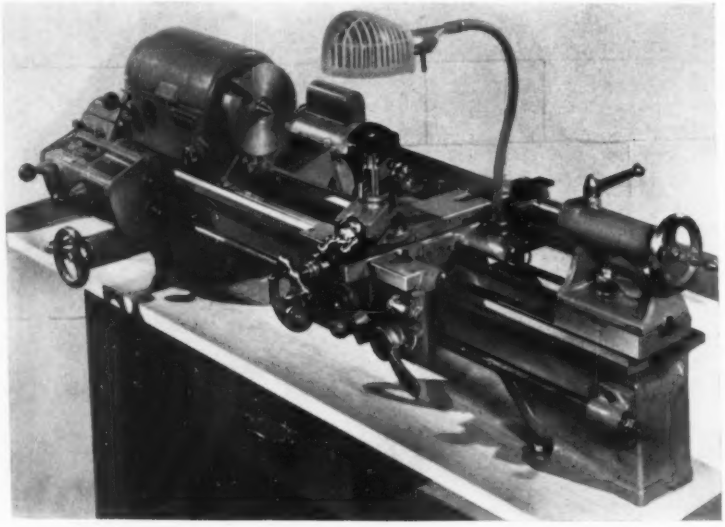
If two "cookies" stick together and are fed into the die, the press is automatically stopped before any damage can occur. The safety device operates by detecting indicated deflection of the press flywheel caused by as little as 0.010-inch additional stock thickness which immediately disengages the air clutch, stopping the press.

Circle Item 575 on postcard, page 173

Delta Lathe with Variable-Speed Drive

A 10-inch metal-cutting lathe, featuring a variable-speed drive and 3/4-inch collet capacity has been introduced by the Rockwell Mfg. Co., Delta Power Tool Division, Pittsburgh, Pa. This lathe has been designed to fill the need for a low-cost lathe to do heavy-duty work in commercial metalworking shops, plant maintenance shops, toolrooms, and other industrial plants. It is compact and easy to operate.

The variable-speed drive provides all the advantages of infi-



Delta lathe in low-cost range brought out by Rockwell Mfg. Co.

nitely variable speed from 50 to 1500 rpm, plus the high-torque transmitting power of matched V-belts in the final drive to the spindle. The smooth, quiet, direct drive can be used extensively for a variety of thread pitches and for heavy cutting.

The 3/4-inch collet capacity is obtained by using a 4-C style collet with a 15/16-inch hole through the spindle. Other features include: a massive, double row, pre-loaded, inboard spindle ball bearing which is sealed against dirt and lubricated for life; V-pulley for the two matched V-belts located between the spindle bearings; a quick-change gear-box that provides a choice of fifty-four feeds or thread pitches; clutch operation which allows an infinite choice of power transmission from a maximum setting for heavy cuts to a light engagement to avoid overloading the motor; and variable-speed drive that can be pre-set on the job to whatever high or low speed limit is desired in either direct or gear drive. For example, in direct drive the speed limit can be pre-set at 500 to 900 rpm (normally 250 to 1500) for rough- and finish-turning, or the many other jobs, especially repetitive work, where pre-setting is an advantage.

The lathe is used with a full 3/4-hp motor and optional Delta bench which has adequate space for separate mounting of the motor. A special motor-mounting kit is also available as optional equipment for mounting the motor at the rear of the lathe headstock. With this kit the lathe can be mounted on any stand or bench.

Circle Item 576 on postcard, page 173

"Miniature Centalign" Internal Grinder

The Bryant Chucking Grinder Co., Springfield, Vt., has announced a "Miniature Centalign" Model B internal grinder, built specifically for grinding bores in miniature-bearing races and internal ball tracks in miniature-bearing outer races. The machine is of extremely compact design, requiring only 8 1/4 square feet of floor space. Work-pieces are automatically loaded, ground, and unloaded by means of the Bryant "Disc Drive Shoe" centerless fixture. This exclusive Bryant feature provides interchangeable "packaged tooling" which can be set up away from the machine if desired. Thus it permits almost uninterrupted machine operation, eliminating the need for long periods of down time previously required when re-tooling for work-part changes.

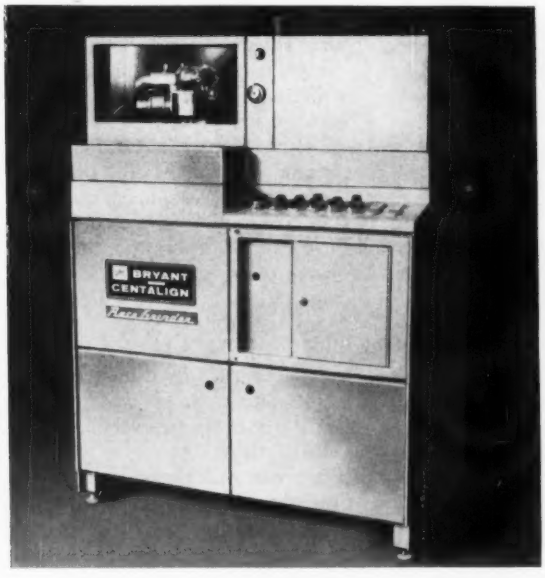
A complete range of bores and raceways in miniature-bearing races up to 0.625 inch, outside diameter sizes, can be ground by means of the Bryant "Disc Drive Shoe" centerless fixture.

Other features include new automatic wheel-dressing and automatic loading and unloading equipment which allows one man to operate several of these machines at the same time. Separate variable cross-feed speeds are provided for both rough- and finish-grinding operations and for selective skip dressing.

Circle Item 577 on postcard, page 173

H-P-M Precision-Controlled C-Press

Unique design features are said to be incorporated in a servo-controlled C-press announced by the Hydraulic Press Mfg. Co., a Division of Koehring Co., Mount Gilead, Ohio. Absolute control of all press actions without unnecessary and space-taking linkages is one of the advantages claimed for this equipment. With the press ram at the top of its stroke and the valve in its closed position, the operator starts the machine by depressing the control lever. The spiral cam connected to the ram then turns a fast-lead feed-screw on the valve-spool actuator. Slow hand motion in actuating the control lever results in a slow ram movement; fast



Bryant "Miniature Centalign" Model B internal grinder

Servo-controlled C-press built by Hydraulic Press Mfg. Co.

action produces a rapid ram movement. Ram motion is positive and smooth.

This C-press is particularly suited to straightening operations. The operator has complete control of ram speed, travel movement, and tonnage imposed on the work.

In a recent test, a watch was placed beneath the ram which was brought down until a piece of paper laid over the watch crystal could be held tightly without breaking the glass. The ram was then retracted slightly by the operating lever so that the paper could be moved slightly, as with a feeler gage. This test, without breaking the glass on the watch, serves to point out the close control the operator has over ram motion—a feature applicable to laboratory as well as production work, die try-out work, compacting tests, and other applications of a research nature where the force of the ram must be accurately controlled.

Circle Item 578 on postcard, page 173

Snyder Center-Column Machine for Processing Cast-Iron and Aluminum Parts

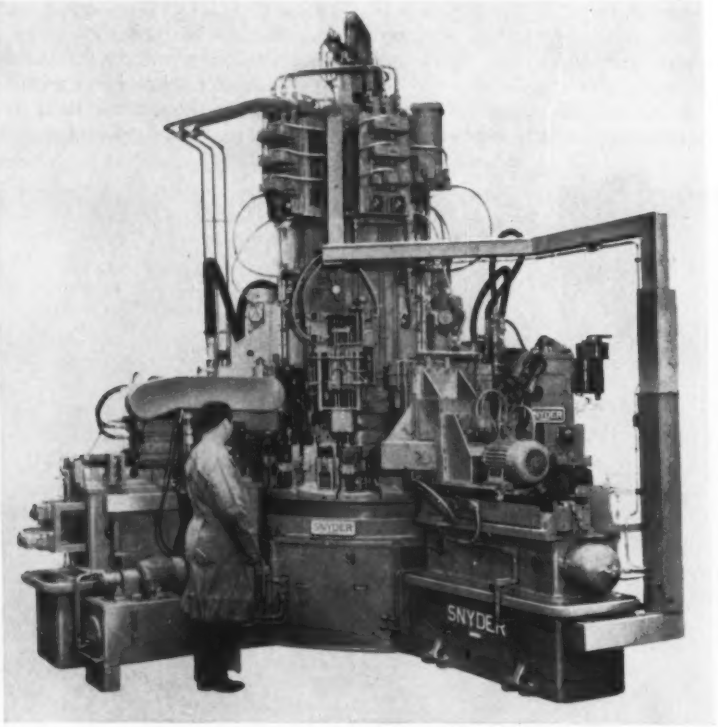
A special center-column machine for processing a variety of cast-iron and aluminum pump bodies at a production rate of 100 parts per hour is announced by the Snyder Corporation, Detroit, Mich. This equipment is designed to handle a variety of similar parts having different location requirements and holes of different sizes. It is of compact design and utilizes an unusual double-index system with two-position fixtures. The differences in the materials of the parts to be processed are taken care of by providing all machining heads with change-gear boxes. The drilling- and tapping-head spindle speeds are increased for machining the aluminum parts by interchanging a pair of drive-gears. Milling-head cutter speeds are increased or decreased by interchanging a pair of drive pulleys.

To obtain the maximum number of machining operations on the 56-inch diameter index-table, eight two-position fixtures are indexed through sixteen stations to produce a finished part at every other indexing movement of the table. When a finished part is unloaded from one fixture position, the part in the other position is moved to the second position and a rough part is placed in the first position. This means that a part goes around the table twice (once in each fixture position) before it is completed.

Automatic hydraulic clamping and unclamping is provided to simplify the loading and unloading function. The machine is so designed that change-over from one part to another of the same material is simply a matter of removing or changing a few tools and inactivating certain machining heads.

All sliding and rotating surfaces on the machine are lubricated by a manually operated, central lubricating system. Oil-mist lubrication is provided for the tapping heads. This machine is hydraulically operated and electrically controlled. It has separate pump and tank units that provide the hydraulic power. The table is also indexed hydraulically by a built-in mechanism.

Circle Item 579 on postcard, page 173



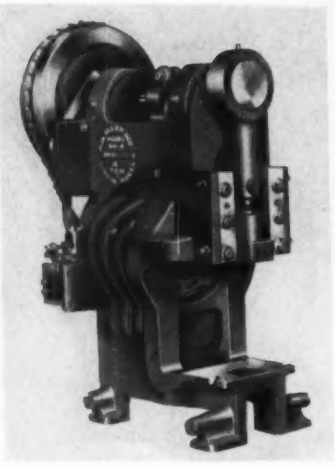
Snyder special center-column unit of the double-index type which machines a variety of cast-iron and aluminum pump bodies

Design Aid Templates

Pic Design Corporation, a subsidiary of the Benrus Watch Co., East Rockaway, N. Y., has brought out fourteen "Design Aid" template sheets to assist engineers and designers in laying out and constructing models of the so-called breadboard type. The templates consist of actual-size drawings on tracing paper. These drawings show in complete, accurate detail standard model parts made by the Pic Design Corporation, including gears, dials, couplings, clutches, cams, shaft hangers, differential-gear assemblies, speed reducer units, etc. In addition, full-size templates of 8- by 8-inch and 16- by 16-inch metal, slotted breadboard plates are included.

With these templates the designer can quickly make a layout drawing by simply placing the part templates in their proper positions on the breadboard template and tracing the details.

Circle Item 580 on postcard, page 173



Allen bench type punch press

Allen Four-Ton Bench Type Power Punch Press

A punch press of completely new design (patent pending) is now being manufactured by Alva Allen Industries, Clinton, Mo. This press has a capacity of four tons and although it was originally designed for automatic crimping of electrical terminals, it can be used for any standard punch-press operation, such as punching, crimping, shearing, blanking, forming, drawing, riveting, and cutting. Of compact design, it is only 10 5/8 inches wide, 17 1/2 inches deep, and 24 5/8 inches high. The main frame casting encases the motor. The flywheel is located at the rear of the press where it does not hinder material feeding from either side.

The press is controlled by a solenoid-operated clutch of the single-pin, knife type, and can be easily changed from repeat (continuous) to non-repeat (single-stroke) action. The clutch also enables the operator to mount the control switch (either hand- or foot-operated) in any position desired. The open-height die space is 6 1/2 inches and the throat depth or distance from center of ram to back of die is 4 inches. The opening in the bed is 2 by 2 inches and the opening between uprights, 4 by 3 inches.

The standard stroke is 1 inch, but special strokes of 1/4 inch to 1 1/2 inches are available at extra cost. The flywheel weighs 40 pounds, is 10 1/8 inches in diameter, and has a face width of 2 3/8 inches. The press, complete with brake, 1/3-hp motor encased in frame casting, solenoid-operated clutch, with one hand or foot control switch, weighs 223 lbs.

Circle Item 581 on postcard, page 173

"Lanhyrol" Thread-Rolling Machine

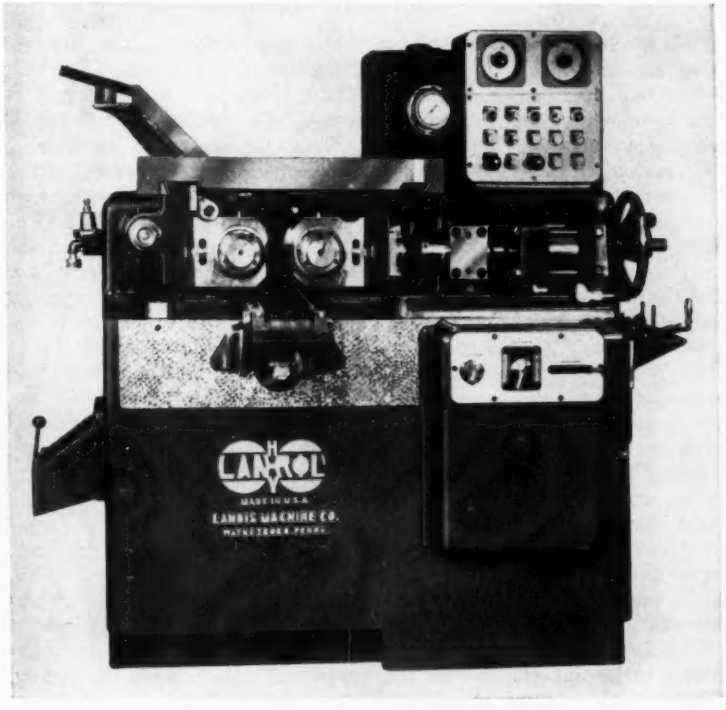
The Landis Machine Co., Waynesboro, Pa., has developed a "Lanhyrol" thread-rolling machine to handle double-end studs up to 13 1/2 inches in length. Through the use of extended spindles, the machines will produce 3/8- to 9/16-inch studs at the rate of 102 per minute and 5/8-inch studs at the rate of 80 per minute. The operation is performed by the "continuous" rolling method, the parts being automatically fed into the machine from an inclined magazine. They are held and carried into rolling position by an indexing work-rest "cage."

The thread-rolling dies are of the segmental type and are held hydraulically at a fixed center distance. They are designed to roll the threads on two parts per die revolution. Upon completion of the threading operation, the parts drop into a conveyor.

Two methods of rolling are available. The first and fastest is by segmental or cam-periphery type dies with mechanical indexing for parts up to and including 5/8 inch in diameter on either single- or double-end work and for 3/4-inch diameter single-end work only. In this range, combinations of coarse and fine pitch threads can be rolled, including left- and right-hand threads, large and small diameters, or identical threads.

The second method is used for work larger than 3/4 inch in diameter on one end only. Plain cylindrical "infeed" dies are used with an automatic infeed cycle and electropneumatic indexing is substituted for mechanical indexing. A change-over from one diameter to another requires only interchanging the thread-rolling dies, magazine chute rails, and work-carrying rings.

Circle Item 582 on postcard, page 173



Landis "Lanhyrol" thread-rolling machine

"Numeripath" controlled 54-inch vertical boring and turning mill developed by Giddings & Lewis

Giddings & Lewis Machines Available with "Numeripoint" or "Numeripath" Controls

All machine tools made by the Giddings & Lewis Machine Tool Co., Fond du Lac, Wis., are now available with either one of two control systems. These systems are designated "Numeripoint" and "Numeripath." The "Numeripoint" control is of the punched-paper-tape, discrete-positioning type. It was described in its application to the Giddings & Lewis vertical turret lathe announced on page 160 of February, 1959, MACHINERY. The "Numeripath" control continuous-path magnetic tape system for contour-machining is of the type employed on the Giddings & Lewis DiMil described and illustrated on page 149 of January, 1959, MACHINERY. The director unit for the continuous-path magnetic tape control system will continue to be known as the "Numericord Director."

The 54-inch vertical boring mill shown in the illustration and the "Numeripath" control which operates it were both developed by Giddings & Lewis. The machine was developed for the Gray Tool Co., Houston, Tex., and will be used for contour-machining of valve bodies. This machine is equipped with a five-position, right-hand turret-head with power indexing, and a left-hand swiveling ram type tail-head. Feed and traverse of turret-head, ram, and saddle can be operated by tape or pendent control, as can the turret-indexing and table speeds. Tape control of the left-hand head was not required by the customer, but can be provided.

On complex, contoured pieces, programming and preparation of tapes will be practical even for one-of-a-kind parts—with the added advantage that duplicate parts can be reproduced accurately from the stored tapes at any time, even years later. On long or frequent runs of simple parts, the tape will reduce setup, machining, and floor-to-floor time substantially. Accuracies and production rates will be predictable and independent of the operator's skill.

The Numeripath control system includes a Giddings & Lewis Numericord director, a magnetic tape recorder, and a control console with tape playback unit. The director interpolates programmed data from a punched paper tape and transmits electrical impulses to the magnetic tape recorder. The permanent recorded tapes thus produced are then used to operate the machine.

Provisional stops for inspection of work or tool can be programmed as required. "Playback" stops can also be provided for taking a second cut on a contour, when required, for greater depth. In this case the tape is run back to the beginning of a cut and replayed for a repeat operation. At any time during tape operation, the machine can be placed under manual operation by a simple switch on the control console. An electrical interlock prevents manual and tape control from functioning simultaneously.

Circle Item 583 on postcard, page 173

Rotary Assembly Machine with Press Station

The Ferguson Machine Corporation, St. Louis, Mo., has brought out a high-speed, rotary assembly machine furnished with an integral pressing station. This unit, designated the Type "O" Pressembler, performs crimping, riveting, staking, and forming operations in conjunction with automatic assembly work in the manufacture of small parts. It can also be used for dial-fed secondary press operations. The equipment incorporates a roller gear drive as the dial-indexing mechanism to provide a smooth transfer movement without sudden starts and stops. The drive achieves an accuracy of 0.001 inch and zero backlash without employing auxiliary locating or locking methods. The minimum operating time without maintenance is rated at 8000 hours.

The capacity of the press station is 14 tons with a 2-inch stroke. The reverse-frame design permits easy access to press bearings, pitman, slide, die, etc., from behind the press instead of over the dial and work stations. Extra-long ram guides eliminate the need for sub-presses except in cases with the most unusual accuracy requirements.

Two models are available, with dial sizes of either 24 or 36 inches, and 6, 8, 12, or 16 stations. The Model "E," for assembly operations requiring long cycle times and variable dwell, has a production rate of forty pieces per minute. The press station and index-table are separately powered and synchronized through electrical interlocks. The Model "M" Pressembler attains production rates up to 150 assemblies a minute. Mechanically timed and synchronized, its dial and press are driven by a single motor.

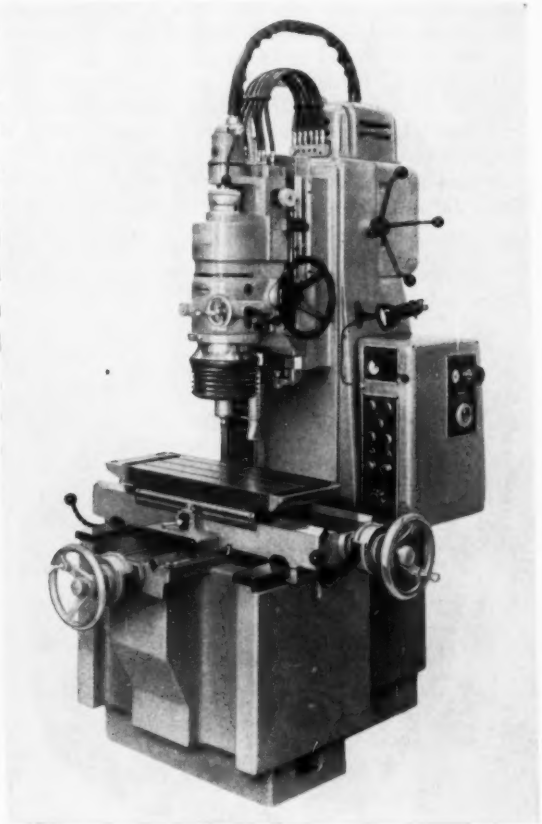
Circle Item 584 on postcard, page 173

Moore Jig Grinder

A No. 3 jig grinder designed to finish-grind tools to fine tolerances for use in missile production has been announced by the Moore Special Tool Co., Inc., Bridgeport, Conn. This machine has a table capacity of 11 by 24 inches by 18 inches high. It will grind straight or tapered holes and regular or irregular contours to size in hardened parts with a high degree of accuracy. Slot-grinding and chop-grinding can also be performed with equal efficiency and accuracy. Spindle speeds are infinitely variable from 40 to 250 rpm. Because of the exceptional accuracy with which this machine is built, it is claimed that it will produce work to tolerances well under 0.0001 inch.

The greatest error in any inch of longitudinal travel is 30 millionths of an inch and only 90

Rotary assembly machine with integrated press station



Precision jig grinder built by Moore Special Tool Co., Inc.

millionths of an inch in 18 inches. The greatest error in any inch of cross travel is 30 millionths of an inch and only 90 millionths of an inch in 11 inches. Squareness of the compound slide (full travel) is accurate within 60 millionths of an inch. The spindle-housing travel error is held to 90 millionths of an inch in 13 inches and the spindle travel, to 90 millionths of an inch in 3 5/8 inches.

Major features of the new machine are: hardened, ground, and hand-lapped steel ways, which eliminate gibs and overhang; infinitely variable spindle speeds within the range of 40 to 250 rpm, permitting faster strokes for chop-grinding; more accessible cross-clamping; micro setting of the vernier dial; and quick-setting precision lead-screws—all of which serve to simplify the finish-grinding process.

Circle Item 585 on postcard, page 173

Moline Special Three-Way Drilling and Milling Machine

The Moline Tool Co., Moline, Ill., has built a Model HHU86, three-way, multiple-spindle drilling and milling machine for processing tractor transmission cases. This machine is essentially a combination of two horizontal drilling units and a milling unit attached to a central base which carries the work-holding fixture.

The drilling unit at the left has forty-seven slip type spindles with universal-joint drives, each accurately located in a bored hole in a slip-spindle plate. Available drilling area is 30 by 54 inches, with 5/16- and 27/64-inch drills, as well as combination 27/64-inch drill and 1/2-inch counterbore. The universal-joint drive permits relocation of spindles to any point within the drilling area by use of a different slip-spindle plate of the required design.

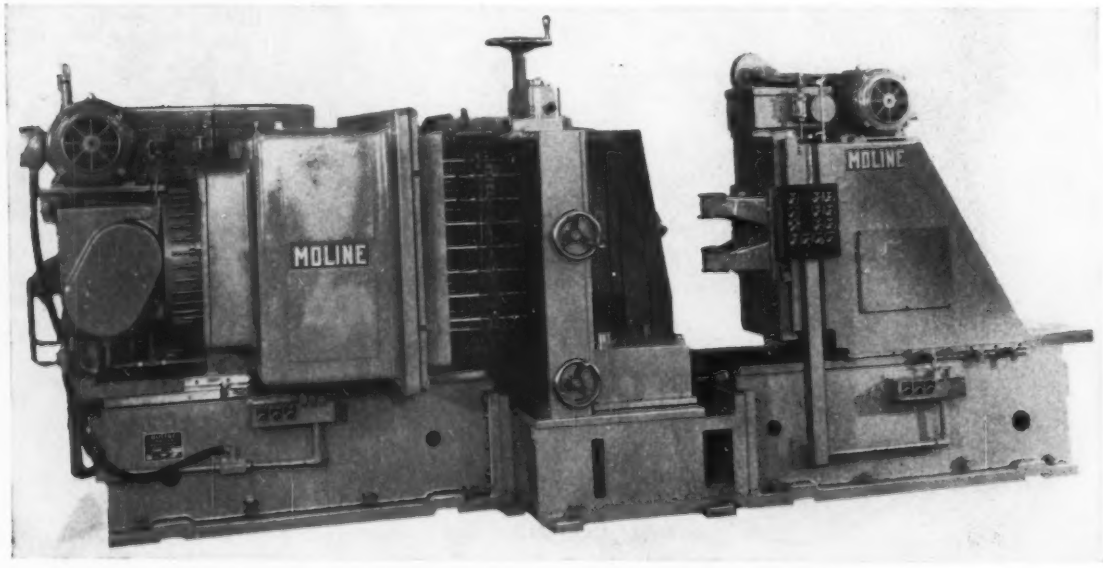
The main drive of the unit is equipped with a two-speed-and-neutral, quick-shift selector which changes the rotational speed of all spindles simultaneously. In addition, each of the fifty-six spindle drivers (which includes nine extra drivers for additional spindles when needed) in this unit is provided with individual two-speed-and-neutral adjustment. A pick-off gear-case is included for changing spindle speeds available through the speed selection devices.

The rear drilling unit (not visible in the illustration) has a main slip-spindle plate that provides a 32-by 18-inch drilling area and carries twelve universal-joint-driven spindles with 17/32-inch drills. Also mounted on this main plate, and about 2 feet ahead of it, is a 10-by 12-inch auxiliary plate carrying eleven similar spindles using 5/16- and 1/2-inch drills for drilling an intermediate wall in the work-piece. This twenty-three-spindle rear unit has all the spindle-speed-changing features available in the forty-seven-spindle unit. Both of the horizontal, universal-joint type drilling units on this machine are adaptable for vertical mounting or as components of transfer type equipment.

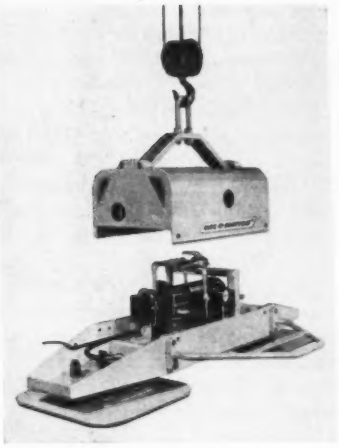
At the right of the work-holding fixture is a two-spindle milling unit. Each of these two vertical spindles carries a pair of milling cutters for machining bosses located in recesses of the transmission case. The vertical distance between the two pairs of milling cutters can be increased, if required, to suit different boss locations.

With a transmission case loaded and clamped in the fixture, an automatic operating cycle is started by push-button control. The standard hydraulic feed cycle for all machine units consists of rapid advance, feed, and withdrawal to starting position. Individual control of the horizontal travel of the drilling and milling units is included for setup and tool adjustment. Renewable guide bushings in the fixture prevent drill runout.

Circle Item 586 on postcard, page 173



Special machine for processing tractor transmission cases built by the Moline Tool Co.



Littell vacuum lifter for steel and non-ferrous plates

Vacuum Lifter for Steel and Non-Ferrous Plates

The Vac-U-Mation Division, F. J. Littell Machine Co., Chicago, Ill., has announced the addition of square-cup vacuum lifters to its line of lifting and moving equipment for handling steel and non-ferrous plates. The unit, shown with the upper housing raised, has two 20-inch square vacuum cups, each with 400 square inches of lifting surface. At 10 psi each cup has 4000 pounds of lifting power, so that with a 4 to 1 safety factor the lifting capacity is still 1000 pounds. The square cups are adapted for use in one-, two-, four-, and eight-cup Vac-U-Mation units.

The vacuum pump is a twin-cylinder, high-volume, dry-piston type. It requires no oil and is capable of maintaining 27 inches of vacuum. The pump has a displacement of 6.57 cubic feet per minute and is driven by a 1/2-hp, 115-volt, one-phase, 60-cycle motor arranged to run periodically so that a minimum of 20 inches and a maximum of 25 inches of vacuum will be maintained in the reserve bank.

This heavy-duty unit is capable of handling even the most rugged jobs. Since the vacuum pump maintains a constant reserve of vacuum in the tank, even an electrical failure will not permit the load to drop for a reasonable length of time.

Circle Item 587 on postcard, page 173

Cleveland IG Beam-Punching Machine

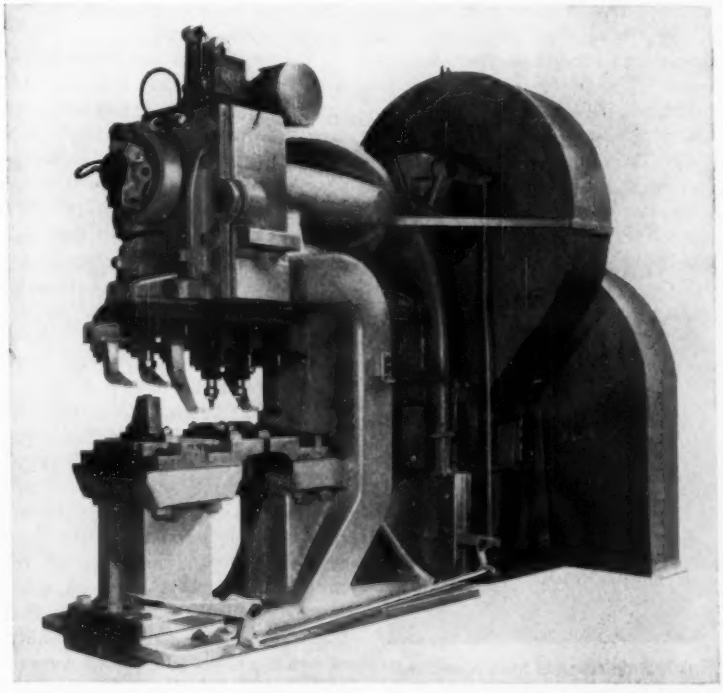
The Cleveland Punch & Shear Works Co., Cleveland, Ohio, has brought out an IG beam-punching machine capable of piercing two 1-inch holes through metal up to 1 inch in thickness. It will accommodate the flange and web of standard 6- to 24-inch I-beams. The unit is designed to punch structural steel shapes in both web and flange, and can also be used in plate work. Equipment includes one high and two low die-holders and three gaged punching attachments. The die-block offers the added convenience of having two dies of different diameters, permitting the punching of holes to close centers.

The equipment has a throat depth of 24 inches, and the outer leg is adjustable. The sliding head and bolster block have T-slots for easy adjustment of hand gaged attachments. The machine is specially designed for use in bridge building, and in railroad, shipyard, and structural shops. It can be used for a wide range of structural-steel fabrication, since it can also be equipped for flue-hole punching, notching, and coping, as well as for shearing angles, plate, or bars.

A convenient treadle or start-and-stop buttons on the frame control the automatic, non-hammering, jaw type clutch with its safety cam-ring. The cam-ring can be adjusted to stop the sliding head at any point in its stroke. The gears and flywheel are completely enclosed.

The main shaft is a hammered-steel forging with the bearing accurately ground and polished to size. The clutch bearing is provided with two keys driven in place and held by two fillister head screws. Bed bearings are bronze-bushed. The sliding head is reciprocated by a pitman and trust block which is oil-grooved and polished. The pitman is a steel casting, bronze-bushed and arranged so that the pressure is always exerted directly over the cutting tool to eliminate undue friction and shifting strains. The machine has a punching pressure of 156 tons. It can also be furnished in various sizes and capacities.

Circle Item 588 on postcard, page 173



Cleveland IG beam-punching machine with one high and two low die-holders

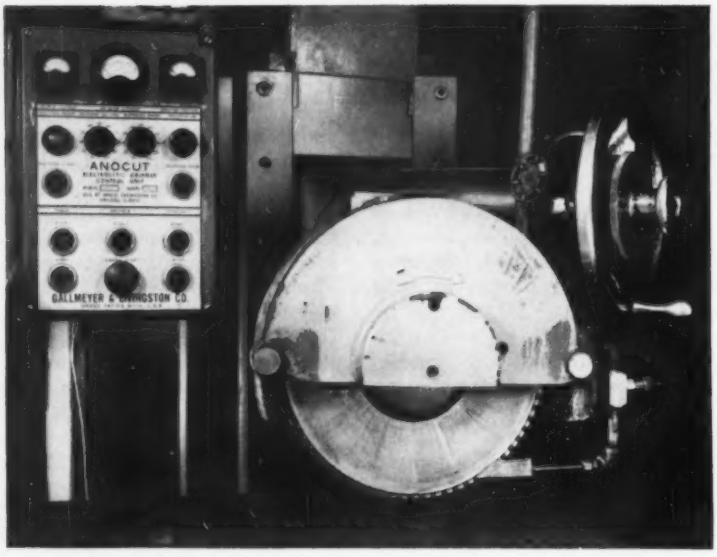


Fig. 1. Gallmeyer & Livingston electrolytic surface grinder equipped with serrated metallic wheel for application of interrupted-arc machining process developed by the Anocut Engineering Co.

Interrupted-Arc Process for Machining Honeycomb Cores

The Anocut Engineering Co., Chicago, Ill., has announced a process for high-speed machining of stainless-steel and aluminum honeycomb cores. In Fig. 1 is shown a Gallmeyer & Livingston No. 36 electrolytic surface grinder equipped with a serrated metallic wheel specially designed for machining stainless-steel honeycomb cores, such as the one illustrated in Fig. 2, by the new interrupted-arc method.

The interrupted-arc process differs from regular Anocut electrolytic machining in that the removal of metal is accomplished, not by electrolysis or "deplating" but, rather, by a series of sparks or arcs of short duration. The grooves or serrations on the working surface of the metallic wheel are wide and deep enough to assure the extinction of the arc passed between the working segments of the wheel and the honeycomb work or foil.

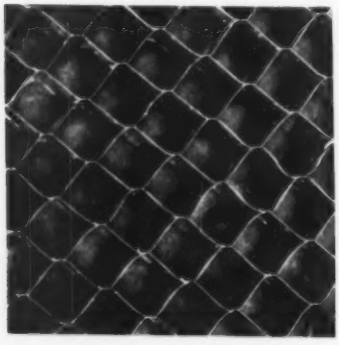


Fig. 2. Stainless-steel honeycomb machined by interrupted-arc process on equipment such as shown in Fig. 1

Test work has been conducted using slots 1/4 inch wide and 1/4 inch deep. The working segments are approximately 0.080 inch wider than the grooves. The wheel or electrode is rotated at a speed to provide approximately 2500 contacts per second, so that this many arcs of brief duration are struck and extinguished, thereby removing the metal foil of the honeycomb structure.

Experiments have been conducted with the new process operating (1) in air, that is, without coolant, (2) with water, and (3) with Anocut electrolyte solutions. The work done without any coolant caused the generation of excessive heat even at quite slow removal rates. The rate of removal and quality of work were improved by the use of water. But the fastest and the best quality of work was obtained with Anocut electrolyte solution. A standard Anocut Model 1000 power-supply unit like that used for true electrolytic machining is employed.

On stainless-steel honeycomb core of 1/4-inch cell size made of 1 1/2 mil foil (Fig. 2), it was possible to remove material to a depth of 0.060 inch at a rate of 30 feet per minute. Flatness was held within 0.001-inch total indicator reading. The width of cut was 0.650 inch.

As a result of tests it is recommended that the interrupted-arc process be used only for roughing and that final finishing be done by Anocut electrolytic machining in which sparking and arcing are held to such a level that no thermal damage can occur.

Circle Item 589 on postcard, page 173

Seven Measuring Tools Added to Kwik-Chek Line

The Industrial Division of the Hamilton Watch Co., Lancaster, Pa., has expanded its Kwik-Chek line to include seven measuring tools. Three of these precision instruments are now available and four more will be put on the market in June. Heading the list of these instruments is the precision dial comparator illustrated, which incorporates the following features: direct reading in increments of 0.00005 inch; range of 0.004 inch; fully jeweled and shock-resistant; and dual-gaging contact pressure and fine adjustment on both stand and gage.

Kwik-Chek precision dial comparator

Circle Item 590 on postcard, page 173

(This section continued on page 168)

SWEET KISSES FOR SWEET CHARITY
PRESS BOTH SIDE BUTTONS AT THE SAME TIME TO RAISE SEPARATING SCREEN
KISSES $1.00
KISSES $1.00

What? Air Polices the Hands Off Policy!

We are not serious, but—

The boys might forget that a kiss doesn't involve the hands but this circuit doesn't. The screen takes care of this. When both his hands depress the actuator buttons, they start the sequence to lift the screen, but "sneaking" one hand off calls for the screen to again guard Miss "Belle-of-the-Bazaar." Our society is pretty romantic so we doubt if this "automatic bolster" will ever become popular. But as a safety feature on presses, brakes and shears the Ross non-tie-down valve, designed to keep both the operator's hands occupied, should become popular.

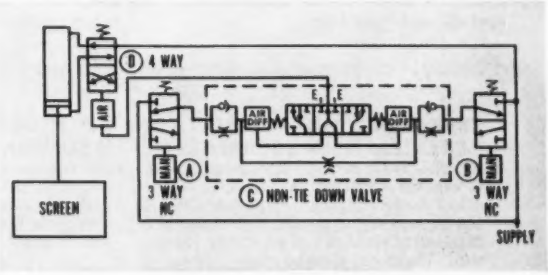
If you are interested in "two-hand safety" you are interested in a Ross non-tie-down valve.

If the operator follows instructions, then two three-way valves, either in series or in parallel, can protect his hands to a degree; but the *operator* who sets his mind to it, can beat either of these hook-ups and keep one hand free. This valve is designed to avoid one hand operation. In the Ross non-tie-down circuit, both three-way button valves are depressed at once to initiate an action and both released before another action can be initiated.

ROSS OPERATING VALVE CO.

110 E. Golden Gate Ave. • Detroit 3, Michigan

The Ross non-tie-down valve is just one of the many designed by Ross to assist in creating safer press circuits. Call your nearby Ross engineer or write for full details.



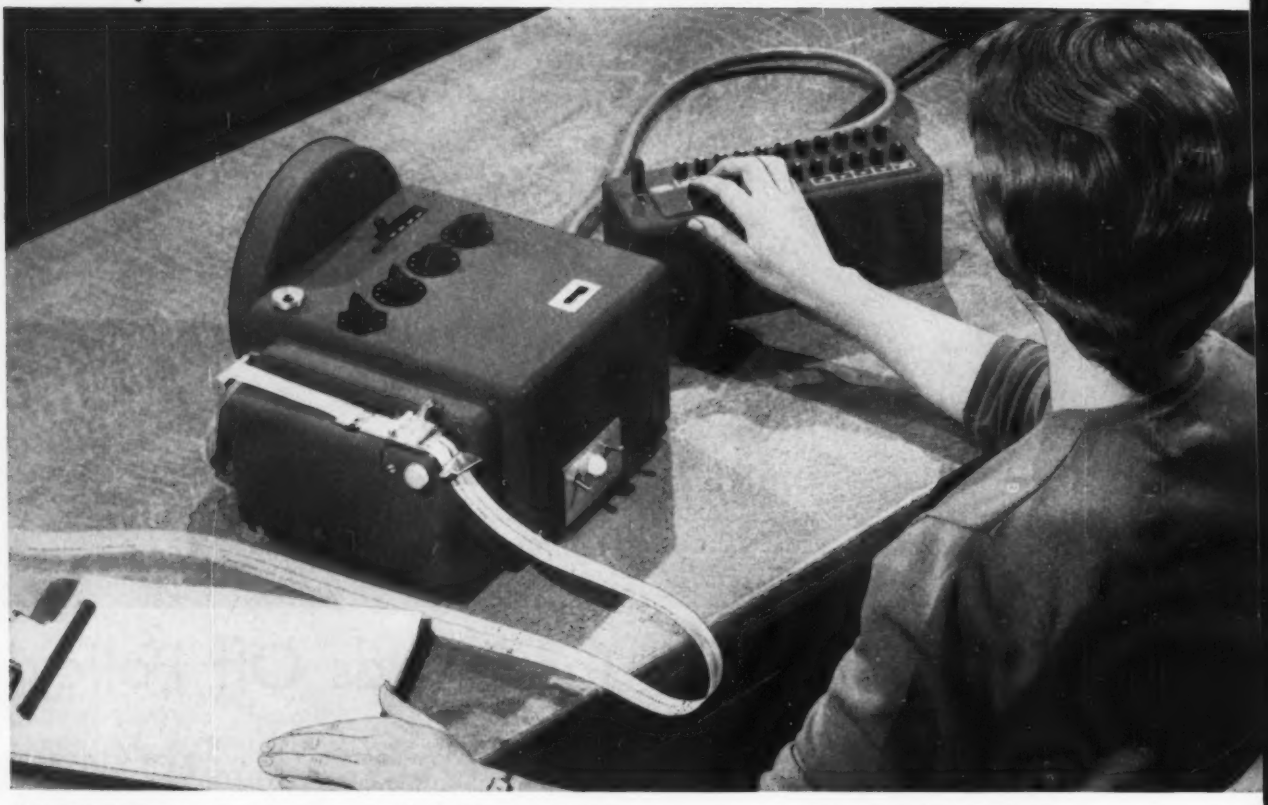
SEQUENCE OF OPERATIONS

- Operating valves "A" and "B" simultaneously permits air to flow through the valve "C", shifting valve "D". Valve "D" operates cylinder raising screen.
- De-actuating valves "A" and "B" simultaneously de-actuates valves "C" and "D". Cylinder retracts and valve "C" re-sets itself for another cycle.
- Operating either valve "A" or "B" independently will *not* cause valve "C" to pass actuating air to valve "D".
- De-actuating either valve "A" or "B" independently, causes pilot air to valve "D" to be exhausted through valve "C". After that occurs both valves "A" and "B" must be released to re-set valve "C" before it will pass air to valve "D" again.

For more data, circle this page number on inquiry card

Here's the PRACTICAL* approach

POTTER & JOHNSTON



***SIMPLE** . . . to understand, operate and maintain.

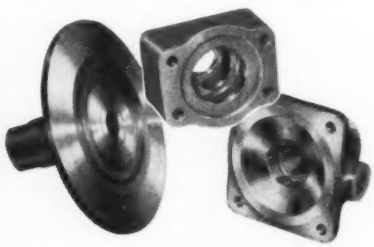
***LOW COST** . . . priced far below other tape control systems.

***SAVES TIME** . . . as much as 25%.

PREPARING THE INITIAL TAPE TAKES LESS THAN 30 MINUTES . . . for the average job, and preparation is readily handled by any clerical or other non-technical employee. Since the tape is easily stored for re-use, additional time is saved on every repeat run. Using a simple code table, a "program chart" is first prepared from the regular operation sheet. No mathematical computations or conversions are involved. Following the coded data on the program chart, the tape is then punched, using the compact tape preparation unit. This is equipped with easily set dials for moving the tape to the correct address points . . . and clearly marked buttons that are pressed to punch all necessary machine commands into the tape.

ALL PROGRAMMING SETUP TIME IS ELIMINATED . . . by simply placing the tape in the machine's tape reader —which takes only a couple of minutes. Unusually compact, the controls are installed as part of the machine and occupy no additional floor space.

PARTS ARE COMPLETED IN MINIMUM TIME . . . under tape control, because the entire machining cycle is programmed by the Engineering Department instead of the setup man. As a result, machine spends *more* time cutting metal, *less* time "cutting air."

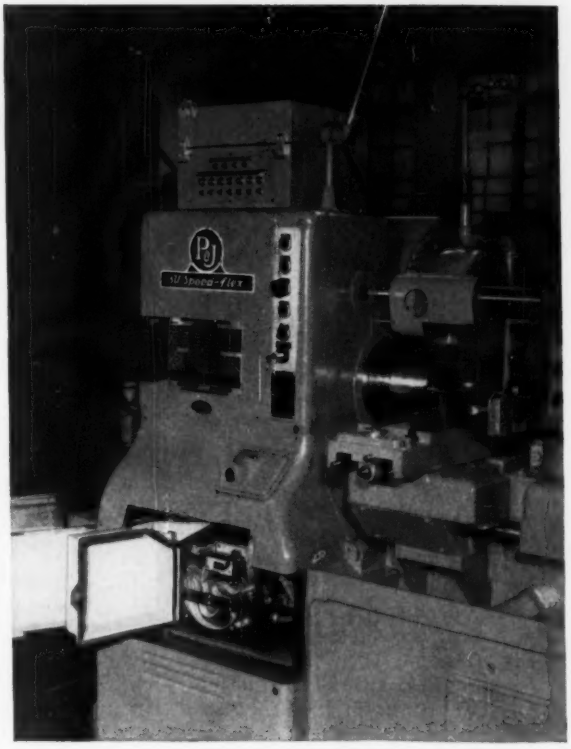


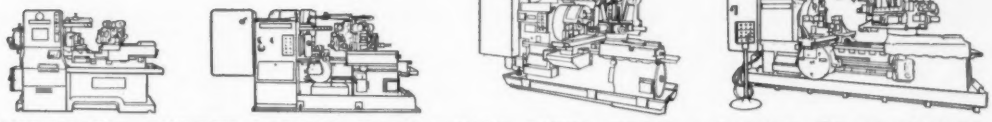
to Automatic Machine Programming

TAPE CONTROL

Potter & Johnston Tape Control is a unique new type of control system that makes the advantages of automatic programming available on a practical, economically realistic basis. The very low initial cost of $3,500.00 is possible, because of its simplicity. It is not electronic, and therefore requires no tubes or transistors. Unlike other systems, P&J Tape Control can be easily added to current models of Potter & Johnston Automatics already in the field, in addition to being available on new machines.

Operating under the P&J Tape Control System, all motions of the machine's spindle, turret and cross slides—including all speed and feed changes—are controlled by a quickly prepared plastic tape. As a result of the increased efficiency made possible by this system, a manufacturer using a P&J Tape Controlled Automatic in regular production has already reported savings of 25% in machining and setup time. In addition, the cost-cutting benefits of automatic machining are now made available for many production runs involving 25 pieces or less.



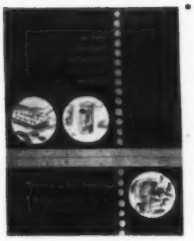


. . . . AUTOMATIC TURRET LATHES WITH CHUCK SIZES FROM 6 INCHES TO 42 INCHES . . . .

POTTER & JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898



YOU'LL FIND ALL THE TIME-SAVING FACTS . . .

on P&J Tape Control in this new circular. Use the coupon here to send for your free copy. See for yourself how this unique system can provide the practical, simple answer to your profit-building, cost-cutting requirements. Potter & Johnston Company, Pawtucket, Rhode Island

POTTER & JOHNSTON Company, Pawtucket, R. I.

Please send my free copy of Bulletin No. 176 fully describing P&J Tape Control for Automatic Turret Lathes.

NAME_____ POSITION_____

COMPANY_____

CO. ADDRESS_____

CITY_____ ZONE_____ STATE_____

For more data, circle this page number on inquiry card

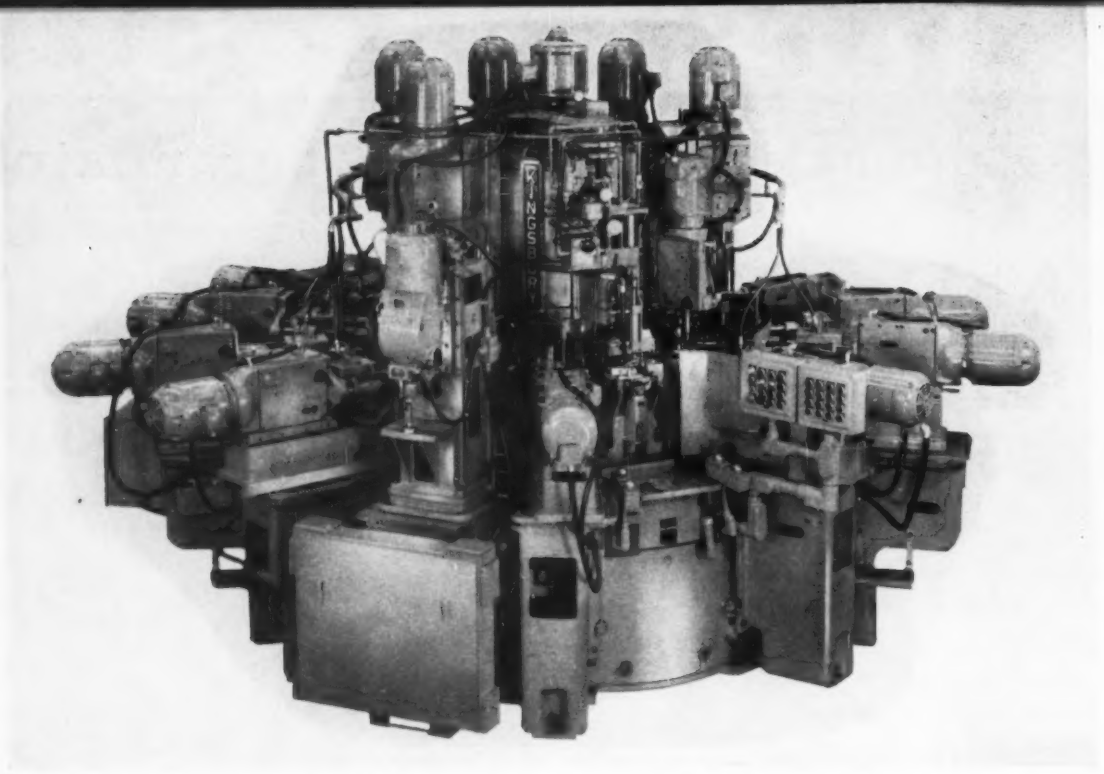


Fig. 1. Automatic machine equipped for processing automotive parts built by Kingsbury Machine Tool Corporation

Kingsbury Multiple-Unit Automatic Equipped to Process Valve Bodies for Automatic Transmissions

The Kingsbury Machine Tool Corporation, Keene, N. H., has just built a multiple-unit automatic with center column as shown in Fig. 1, which performs forty-four operations on valve bodies for automatic transmissions. Nineteen units mill, drill, countersink, ream, and tap valve bodies, like the one shown in Fig. 2, at a gross rate of 300 parts per hour. A 63-inch index-table holds fourteen work fixtures equipped for power clamping and automatic unclamping. The operator nests the work in the clamping ram with the large joint face up. When he presses two buttons, an air cylinder depresses a vertical ram that causes the part to be clamped up against a locating plate.

On a separate column in the left front part of the machine is a vertical unit that mills the face. A motorized-spindle unit drives a milling cutter at 7200 rpm. This unit is counterbalanced on the column with a drilling unit so that the feed of the drilling unit passes to the milling cutter.

On the center column are six vertical units that drill seventeen holes in the joint face, ream three, and tap one. Mounted on knees are twelve horizontal units that operate on six holes. Four holes are so deep that the drilling is done in three steps to keep within the allotted time cycle.

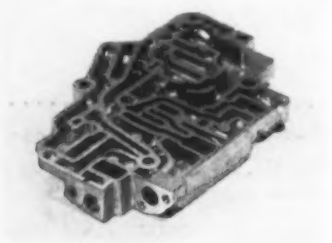
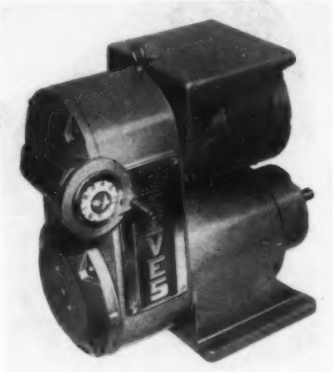


Fig. 2. Valve body for automatic transmission processed by machine shown in Fig. 1

Circle Item 591 on postcard, page 173

Reeves Motodrive with "Scoop" Mounting

A motor-mounting assembly for the Reeves variable-speed Motodrive has just been announced by the Reeves Pulley Co., Columbus, Ind., a division of Reliance Electric & Engineering Co., Cleveland, Ohio. It is designed to save time in making installations. This compact "Scoop-Mounted" Motodrive is designed to rigidly support a separately foot-mounted,



Reeves "Scoop-Mounted" Motodrive

ball-bearing standard NEMA horizontal motor. With this equipment the motor can easily be removed and a new stock motor installed in case of failure.

The heavy-duty, cast-iron scoop type platform, which is securely bolted to the drive frame, supports the motor. The motor can be bolted to the scoop and its shaft

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NAVIGATIONAL TRIUMPH . . .

. . . thanks to ultra precision pioneered by the Société Genevoise d'Instruments de Physique, with the help of Mobil

Up periscope! And there it is—right on target—the floating ice island known as weather station Alpha. The atomic sub, U.S.S. Skate, recently scored this navigational "bull's-eye" after traveling 248 miles, deep under Arctic ice, without a look at sun, stars—communication of any kind. Sharing the credit for this uncanny accuracy was the Navy's new inertial navigation system built by North American Aviation on precision machines provided by the Société Genevoise d'Instruments de Physique (SIP).

SIP, with a century of experience, today builds machines with master *standard scales* accurate to a micron (0.00004"). Lubrication in this realm of precision is critical. Friction and wear must be cut to virtually zero. Yet a film of ordinary oil is too thick . . . can cause machine inaccuracies. SIP relies on Mobil to solve such critical lubrication problems . . . specifies Mobil lubricants for all SIP machines. What better proof that Mobil can solve your most critical lubrication problem?

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The December, 1958 issue of Socony Mobil's magazine, Oil Power, will feature the story of the Société Genevoise d'Instruments de Physique and the vital part it plays in today's precision standards for industry. To obtain a free copy, send your name and address to Socony Mobil Oil Company, Inc., 150 East 42nd Street, New York 17, N. Y., Room 2052.

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connected to the constant-speed disc assembly of the Motodrive.

The "Scoop-Mounted" Motodrive is available in sizes from 1 through 10 hp. Other Motodrives are available up to 40 hp.

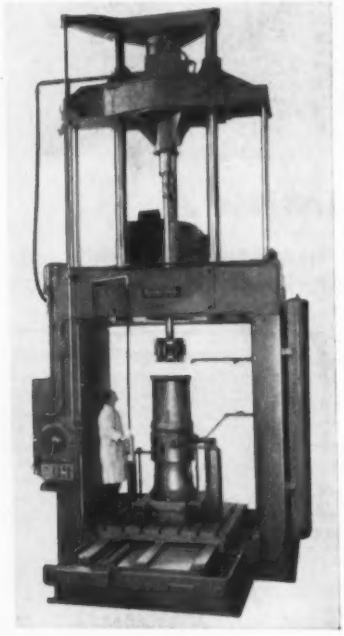
Circle Item 592 on postcard, page 173

Machine for Honing Giant-Size Cylinder Liners

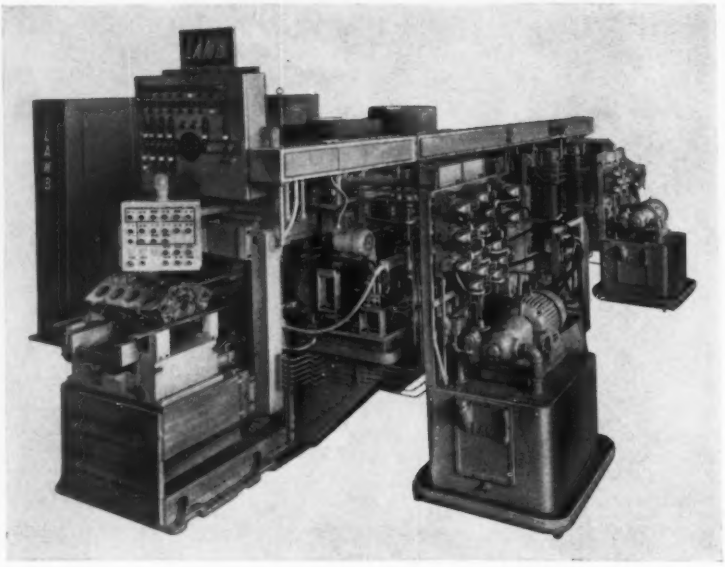
The Barnes Drill Co., Rockford, Ill., has just installed an extra-heavy-duty machine for honing large bearings, cylinders, cylinder liners, marine and diesel engine parts, and compressor cylinders in the plant of a heavy-equipment manufacturer. The unit has a capacity for honing work up to 36 inches in diameter and 72 inches in length. It has a 30-hp motor on the head and a 20-hp motor on the hydraulic unit.

The machine shown is equipped for pneumatic hone expansion. It has a spindle stroke of 80 inches and is used for honing cast-iron cylinder liners from 14 to 19.5 inches in diameter and 70 inches in length. Stock is removed to a depth of 0.010 to 0.020 inch by the honing operation. A finish of 7 to 32 micro-inches is obtained.

Circle Item 593 on postcard, page 173



Heavy-duty Barnesdril single-spindle vertical honing machine



Lamb automatic machine for assembling welch plugs in engine blocks

Transfer Machine Designed to Automatically Assemble Welch Plugs and Pipe Plugs in Engine Blocks

A nine-station transfer type machine designed and built by F. Jos. Lamb Co., Detroit, Mich., applies sealer, assembles eight welch plugs, and runs four pipe plugs to depth in 121 engine blocks per hour. All operations are completely automatic.

The airtight sealer system of this equipment requires very little attention for efficient operation. The machine was designed as part of an automatic, engine-block transfer line. However, it is a self-sufficient unit, and can be used separately or incorporated into any block-processing line. The first station is equipped to accept blocks that are loaded automatically or manually.

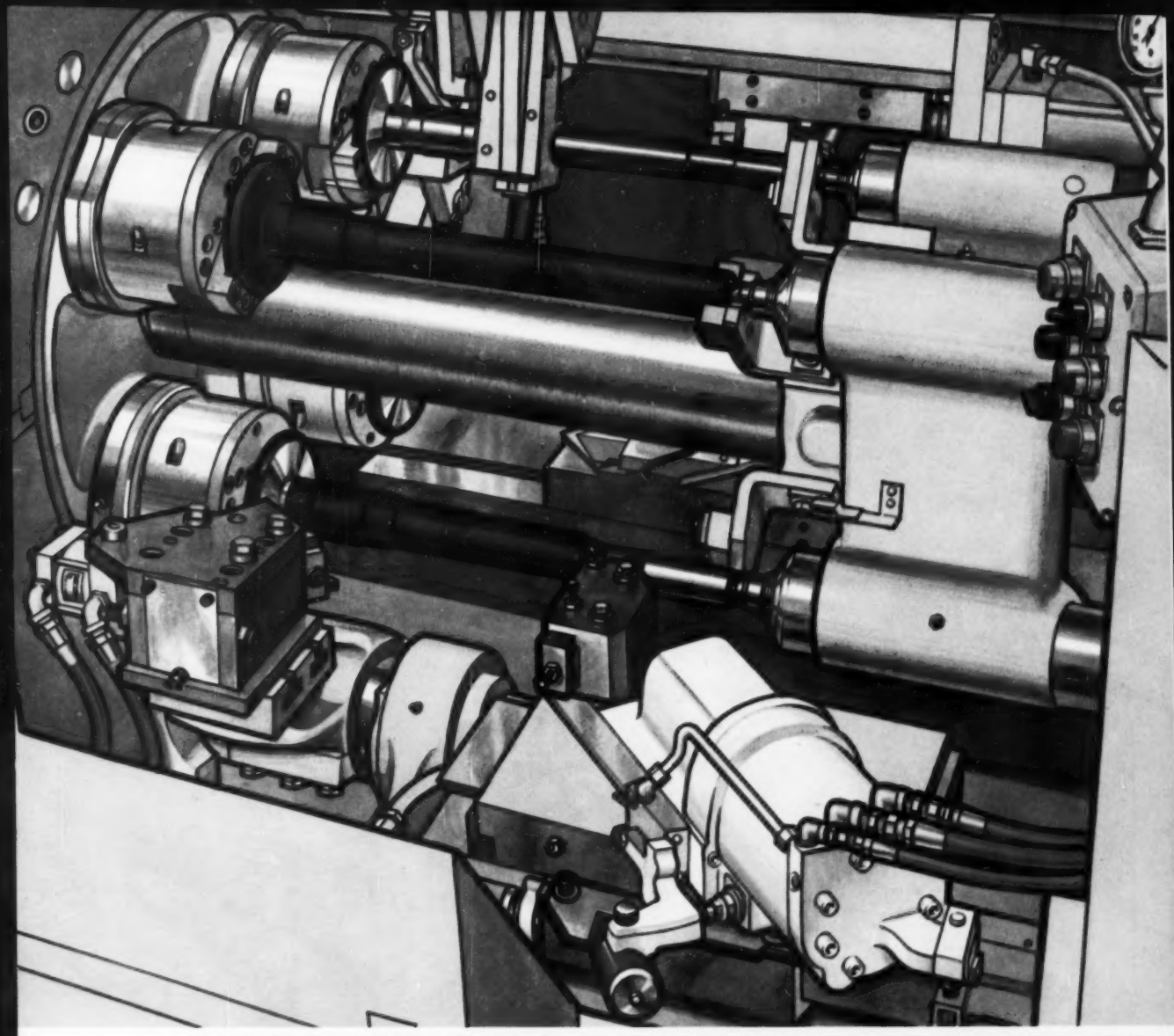
The sealing stations feature unitized construction. Sealing compound is fed from a central pressurized tank through the spindles and applicator quills. Each spindle is equipped with a metering unit and just the right amount of compound is applied through the rotating quill in a single bead around the hole seat. Welch plugs are fed from motorized hoppers through chutes into hydraulically actuated shuttles. The shuttles space and load the welch plugs onto the nose of the pressing mandrels while in the back position. The mandrels rotate and expand the plugs in the holes. Pipe plugs are started manually, then run to depth and tightened to the predetermined torque by pneumatic wrenches which are mounted on a hydraulically actuated slide.

A shuttle type transfer mechanism moves the blocks through the machine. The blocks are positioned on locating pins and clamped by an overhead hydraulic clamping bar. Additional features which assure high production efficiency and operating convenience are: automatic lubrication, manifolded hydraulic components, schematic light panel to indicate machine function or malfunction, and swivel push-button panel for right or left side operating position. Each station has individual control buttons to permit independent operation. All electric, hydraulic, and pneumatic components conform to JIC standards.

A Lamb two-station, block air-test unit can be added to the machine or integrated elsewhere in the processing line. The air-test unit automatically shuttles rejected blocks onto a reject conveyor.

Circle Item 594 on postcard, page 173

(*This section continued on page 178*)



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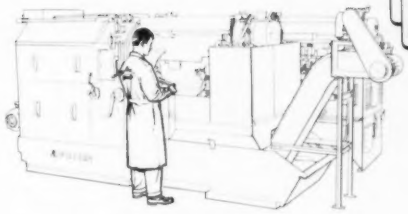
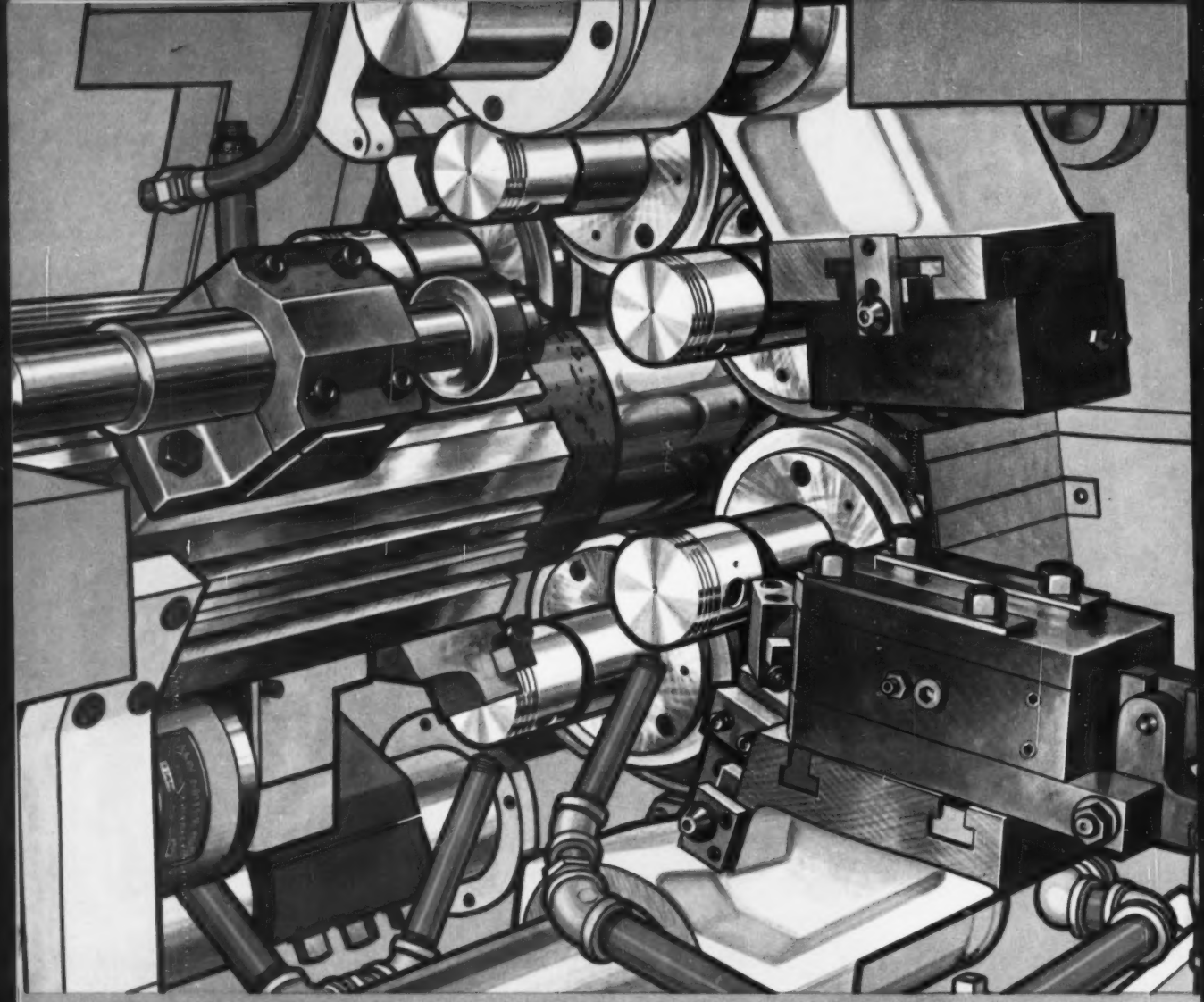
New Britain 4-spindle copying lathe

For the first time... multiple spindle copy turning. Loading station and three work stations. Work chucked between centers which index together. Template-controlled hydraulic slides perform copy turning; cross slides and/or forming arms perform a wide variety of additional operations. Two-speed spindles, automatic loading and unloading, and automatic chip conveyor optional. The New Britain Machine Company, New Britain-Gridley Machine Division, New Britain, Connecticut.



Model 412/25 Copying Lathe



make higher production pay for itself

A New Britain four-, six- or eight-spindle chucker with open-end design, massive forming arms, large capacity (up to 15″) will machine your castings and forgings faster at less cost. You can measure it in *income* instead of *cost* because New Britain Chuckers pay as they go. New Britain's new financing plan makes large initial investment unnecessary. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

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2. **Circle item numbers of new equipment, catalogue descriptions.**
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NEW CATALOGUES

CASTINGS—Meehanite Metal Corporation, New Rochelle, N. Y. Bulletin No. 35, entitled "Meehanite Castings Serve All Industry," containing forty-three illustrations showing applications covering almost every major industry and giving table of physical properties of the types of metals available. Copies may be obtained by requesting them on company stationery from Meehanite Metal Corporation, 714 North Ave., New Rochelle, N. Y.

BRASS—Titan Metal Mfg. Co., Bellefonte, Pa. Revised booklet on brass rod mill products, giving weight, size and tolerance tables, specifications, and other technical data in handy form. Titled "For Your Metal Money's Worth," it is available by writing to: Customer Service Division, Titan Metal Mfg. Co., Bellefonte, Pa., on company letterhead.

TUBE BENDERS—Wallace Supplies Mfg. Co., Chicago, Ill. Catalogue discussing the critical bending of thin-wall, high-strength alloy tube for applications in missile and jet plane work. Request this catalogue on your letterhead of Wallace Supplies Mfg. Co., 1300 Diversey Parkway, Chicago 14, Ill.

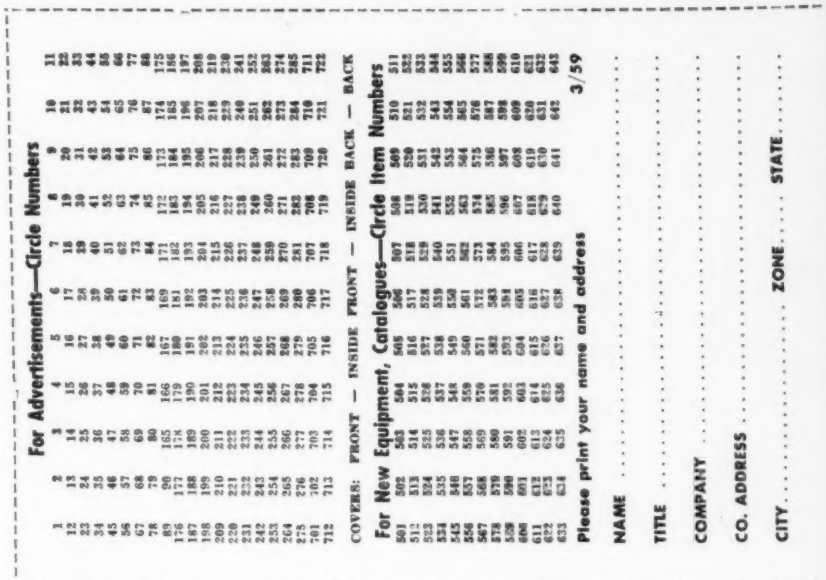
LAYOUT TEMPLATES—Repro-Templets Inc., Oakmont (Allegheny Co.), Pa. 102-page catalogue listing reproducible templates available for the layout of machines, material, shop equipment, etc. Write for this on your letterhead to Repro-Templets Inc., 5 Pennsylvania Ave., Oakmont (Allegheny Co.), Pa.

GENERAL INFORMATION—Carborundum Company, Niagara Falls, N. Y. Information kit to make it easier to specify and order coated abrasives, containing a Buyer's Guide, Form A 1506, with convenient reference tables and forms for listing your requirements; a Selector Chart for Metalworking Operations, Form A 1507; a Selector Chart for Woodworking Operations, Form A 1508; a compact brochure, "Basics in Coated Abrasives for the Metalworking Trades," Form A 1509, and a brochure, "Basics in Coated Abrasives for the Woodworking Trades," Form 1510. . . . . **501**

DRILLING, TAPPING, BORING—Burg Tool Mfg. Co., Inc., Gardena, Calif. Bulletin illustrating the world's largest line of turret type drilling, tapping, and boring machines built by the company. The bulletin shows their line of standard Burgmaster turret drills, including the hand-operated turret drills, radial type automatic hydraulic, numerically tape-controlled, special type turret drills, and their line of Tool Flex floating toolholders. **502**

ALLOYS—Haynes Stellite Co., Division of the Union Carbide Corporation, New York City. Booklet covering five top wear-resistant alloys in the form of investment castings. Investment casting offers designers these alloys in forms and shapes sometimes impossible to make by other methods. Four of the alloys are "Haynes Stellite" alloys No. 3, No. 6, No. 12, and Star-J Metal. The other is "Haynes" alloy No. 93. . . . . **503**

GEAR FINISHING—Michigan Tool Co., Detroit, Mich. Bulletin No. 999, describing abrasive hard-gear finishing as a new



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process for correcting the heat-treating imperfections (nicks, burrs, scale, etc.) of external gears. It also covers machine construction and specifications, the economical finishing tools, and the optional (interchangeable) equipment for finishing internal hard gears. **504**

POWER LUBRICATION—Lincoln Engineering Co., St. Louis, Mo. Catalogue No. 81, describing a complete line of lubricant-application equipment, fittings and accessories. Included are descriptions of completely automatic centralized systems, and semi-automatic and manual methods of lubricating machines. . . . **505**

COOLANT—Associated Technical Sales Co., Dayton, Ohio. Catalogue presenting a unique method of packaging water-soluble coolant, called "Coolie Coolant." This concentrate is available in 6-ounce cans for economical and convenient methods of refilling all vapor mist generators. **506**

MOTOR APPLICATION—Century Electric Co., St. Louis, Mo. Motor Application Guide (Form 270 A), which is applicable to all industry. Nine major factors in motor selection are described in detail. Polyphase, single-phase, and direct-current motor selection charts are included. **507**

MOTOR CONTROLS—Industrial Control Division, the Arrow-Hart & Hegeman Electric Co., Hartford, Conn. 80-page catalogue No. 14, giving complete size, weight, and ratings information. It is arranged to provide quick, easy reference to the manufacturer's complete line of motor controls and accessories. **508**

POWER TRANSMISSION — American Pulley Co., Philadelphia, Pa. Bulletin describing a complete line of power-transmission equipment. It contains a brief description of the major features of American's speed-reduction drives; screw conveyor drives; adjustable speed drives, both standard and wide range; motor bases; and pulleys. **509**

TEST CUTTING SERVICE—DoALL Co., Des Plaines, Ill. Brochure describing the two new Demonstration-Test Centers now in operation by the company. Test cutting of actual work-pieces submitted by customers permits an accurate appraisal of cost per cut, tool life, and production rates before the actual purchase of a DoALL machine tool. **510**

MILLING MACHINES—Consolidated Machine Tool Division, Farrel-Birmingham Co., Inc., Rochester, N. Y. Bulletin 675-A, describing the line of special "Newton" milling machines. Types included are straight-line, vertical open-side, sliding head, shuttle, rise and fall, rotary-index, traverse, planer, and traveling column. **511**

LAPPING AND BURNISHING MACHINES—Foote-Burt Co., Cleveland, Ohio. Circular 512, illustrating the company's line of bearing-surface finishing machines for straight shafts, crankshafts, and camshafts. **512**

TUBING—Peter A. Frasse & Co., Inc., New York City. Tubing chart (Data Chart Sec. B, No. 3) explaining the method for calculating the tube size required to machine to a finished dimension. It gives typical examples to follow and clearly explains differences in outside and inside diameter chucking. **513**

METAL-TURNINGS CRUSHER—American Pulverizer Co., St. Louis, Mo. Brochure covering the complete line of American metal-turnings crushers. Included are specifications and illustrations of six models ranging in capacity from 2 1/2 to 50 TPH, plus information on the economies of reducing metal turnings to shoveling chips. **514**

BORING AND TURNING MILLS—G & L and Hypro Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. Catalogue No. VBM-4, describing G & L Hypro vertical boring and turning mills, available in all sizes. It describes unusual features, attachments, and gives speed and horsepower ranges. **515**

SINTERED NYLON PARTS—Halex Corporation, Detroit, Mich. Brochure featuring Nylasint nylon parts which are components formed by cold-pressing and oil-sintering nylon powders in a process somewhat similar to that in forming powdered-metal parts. A new porous type of Nylasint is also described. **516**

FASTENERS—Standard Pressed Steel Co., Jenkintown, Pa. Bulletin (Form 2449) describing SPS's complete line of standard precision industrial fasteners—including socket screw products, pressure plugs, lock-nuts, spring pins, dowel pins, and steel collars. **517**

QUENCHING—Gleason Works, Rochester, N. Y. Brochure describing No. 117 quenching machine designed for quenching automotive ring gears and other round, flat, and cylindrical parts. . . . **518**

ENCLOSED SWITCHES—Micro Switch, Freeport, Ill. Catalogue 83c, covering a complete line of industrial enclosed switches. This catalogue, together with Catalogue 84, covers the complete Micro Switch line of industrial enclosed and heavy-duty limit switches. **519**

A.C. MOTORS—Reliance Electric & Engineering Co., Cleveland, Ohio. Bulletin B-2103-4, giving concise selection data to users of A.C. motors from 1 through 200 hp. Included are brief explanations of NEMA design classes, speed-frequency relationship, current and torque values, etc. **520**

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DIE CASTINGS—New Jersey Zinc Co., New York City. Booklet, new and completely revised edition of "The End Uses of Zinc Die Castings," containing 192 new photographs, 2 new sections, 14 additional pages, and many new applications of zinc die castings. **521**

CORROSION PREVENTION—Metallizing Engineering Co., Inc., Westbury, N. Y. Bulletin 93XG, describing the Metco metallizing systems, a series of techniques developed through the use of properly treated pure metals which are metallized to a steel base. **522**

SPEED REDUCERS—Winsmith, Inc., Springville (Erie County), N. Y. Catalogue No. HSDR-58, presenting the company's double-reduction, hollow-shaft, worm-gear speed reducers in both Series "STD" torque-arm and Series "SFD" flange-mounted types. **523**

STAINLESS STEEL—Kennametal Inc., Latrobe, Pa. Bulletin entitled "Stainless Steel Machining Data," discussing feeds, machining speeds, and grades of carbide cutting edges best suited for roughing, semifinishing, and fine finishing 188 compositions of stainless-steel types from 201 to 502. . . . . **524**

ALUMINUM PRODUCTS—Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill. Booklet listing and describing the company's mill products. General information, description of characteristics, and typical properties are given. **525**

WELDING—Linde Co., Division of Union Carbide Corporation, New York City. Booklet F-7825, describing Sigma welding. It has been revised to include latest recommendations for this welding on all commercially available metals. **526**

FINISHING—Industrial Equipment Division, R. C. Mahon Co., Detroit, Mich. Booklet A-659, giving information on finishing systems and featuring typical custom installations already in operation in automotive, appliance, and other industrial plants. **527**

POLISHING AND BUFFING—Wilson Buffing Chuck & Machine Co., Warren, Mich. Catalogue illustrating how automation is now possible in the field of polishing and buffing. Clearly shown are models available for continuous straight-line, rotary, or reciprocating action. **528**

CUTTING TOOLS—Quality Tool Works, Waukegan, Ill. Catalogue illustrating a complete line of standard and special high-speed steel cutting tools for toolroom and production use, including several styles of Woodruff keyseat cutters, milling cutters, and slitting saws. . . **529**

STEEL DATA CARD—Allegheny Ludlum Steel Corporation, Pittsburgh, Pa. Data card presenting information on high-temperature steels and alloys. It lists nineteen special metals used in high-temperature applications. **530**

LATHES—Carl Hirschmann Co., Inc., Manhasset, N. Y. Catalogue describing the extreme versatility of the Schaublin SV-102 lathe. It illustrates the many uses of the SV-102 as a toolmaker's lathe, second-operation lathe, and as a turret lathe. **531**

TOOL STEEL—Universal-Cyclops Steel Corporation, Bridgeville, Pa. Brochure describing "LO-AIR" tool steel. It contains complete technical data on machining, heat-treatment, and mechanical and fatigue properties of this new tool steel. **532**

ADHESIVES AND COATINGS—Adhesives & Coatings Division, Minnesota Mining & Mfg. Co., Detroit, Mich. Catalogue describing design concepts, typical applications, and general characteristics of a variety of adhesives, coatings, and sealers. **533**

NEEDLE THRUST BEARINGS—Torrington Co., Torrington, Conn. Catalogue No. 759, covering needle thrust bearings with increased capacity ratings. **534**

JIB CRANE—All-State Engineering Co., Inc., Milwaukee, Wis. Circular presenting two types of crane for numerous applications. Dimensions are given. **535**

O-RINGS—Garlock Packing Co., Palmyra, N. Y. Bulletin AD-148, dealing with the design and application of O-rings. It discusses materials of construction, dynamic and static applications, use of back-up or non-extrusion rings, and groove design for this style of packing. **536**

JIG BORERS—Pratt & Whitney Co., Inc., West Hartford, Conn. Circular describing a No. 4EA numerically controlled jig borer having 70-inch height and 80-inch

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bolt-circle capacities. Various applications of the machine tool are also included in the circular. 537

SURFACE PLATES—Herman Stone Co., Dayton, Ohio. Bulletin 102, describing and illustrating Tol-Check, a new instrument for rapidly checking the tolerance accuracy of surface plates. ...538

PUNCHING AND SHEARING—Klingsicks' Machine Shop, Kingfisher, Okla. Bulletin P-N-S-12, introducing a new type of "Punch-N-Shearing" machine soon to be put on the market. 539

CARBIDE TOOLS—Coromant Dept. Sandvik Steel, Inc., Fair Lawn, N. J. Catalogue 520, presenting a newly enlarged line of Coromant carbide blanks, inserts, tools, and tool-holders. 540

STRAIN GAGES — Baldwin-Lima-Hamilton Corporation, Electronics & Instrumentation Division, Waltham, Mass. Catalogue featuring SR-4 strain gages, instruments, and accessories. It contains over 250 types. 541

COLD SAWS—Consolidated Machine Tool Division, Farrel-Birmingham Co., Inc., Rochester, N. Y. Bulletin 537-A, describing Newton cold saw machines for cutting ferrous and non-ferrous metals. Machine sizes, given in saw-blade diameters, range from 32 to 120 inches. 542

INCLINABLE PRESSES—Federal Machine & Welder Co., Warren, Ohio. Bulletin No. 52112, illustrating and describing the Warco line of open-back inclinable presses in capacities from 40 to 200 tons. 543

DRILLING MACHINE—Buffalo Forge Co., Buffalo, N. Y. Bulletin 3257-C, featuring a redesigned Buffalo variable-speed drilling machine now available in capacities up to 2 inches in mild steel. 544

SPEED DRIVES—American Pulley Co., Philadelphia, Pa. Bulletin describing the operation and application of wide-range, adjustable-diameter, wedge-belt sheaves. 545

FLEXIBLE COUPLINGS—Acme Chain Corporation, Holyoke, Mass. Catalogue containing helpful information on the various types of Acme couplings, dimensions, prices, horsepower ratings, etc. 546

MOUNTINGS AND JOINTS—Lord Manufacturing Co., Erie, Pa. Bulletin No. 713, describing full bonded tube form mountings and Dynaflex joints, specially engineered for vibration and shock control. 547

GENERAL-PURPOSE PRESSES—Minster Machine Co., Minster, Ohio. Bulletin featuring Minster Series 1 limited specification Type O.B.I. (open-back inclinable) presses in capacities from 35 to 75 tons. 548

SHIM AND GASKET SELECTION—General Gasket, Inc., Middletown, Conn. "Ready-Reference" card, designed to facilitate selection of the various gages of "Color-Plast" shim and gasket material by color identification. 549

DEEP-HOLE DRILLING—20th Century Machine Co., Utica, Mich. Circular describing machines for deep-hole drilling operations. 550

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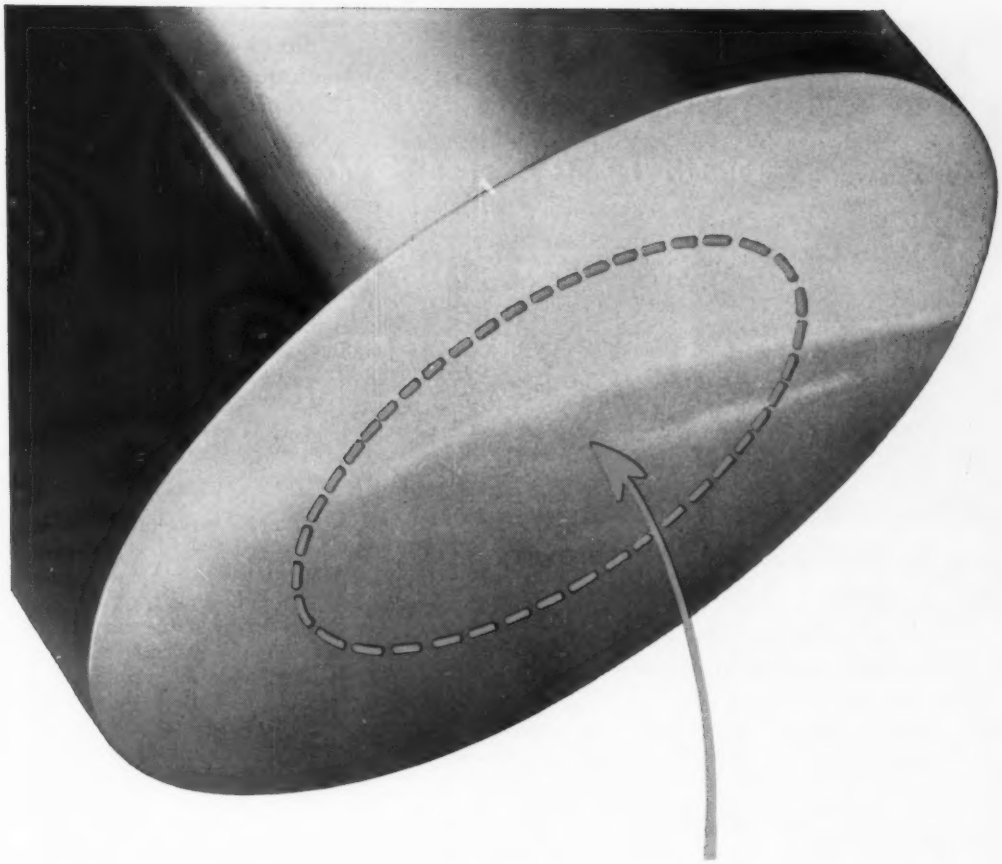

Here's where hollow parts makers can find new savings

IF YOU'RE boring out bar stock to make hollow parts, you can save money, time and steel. Start with Timken® seamless steel tubing because:

1. YOU SAVE THE COST OF DRILLING; the hole's already there. Finish boring becomes your first production step.

2. YOU SAVE MACHINE TIME by eliminating this costly, original boring operation. You free screw machine capacity for other jobs, increase machining stations *without* adding machines.

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And you get finished parts of better quality from Timken seamless steel tubing. We forge a solid round over a mandrel, thoroughly working the metal inside and out. This rotary piercing operation gives seamless tubing its fine forged quality and unvarying spiral grain flow. Precise control of temperature and piercing speed helps assure you of uniform quality from tube to tube, heat to heat, order to order.

To save even more steel, have our engineers recommend the one most economical tube size for your hollow parts job. We'll guarantee it to clean up to your finish dimensions. The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

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SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

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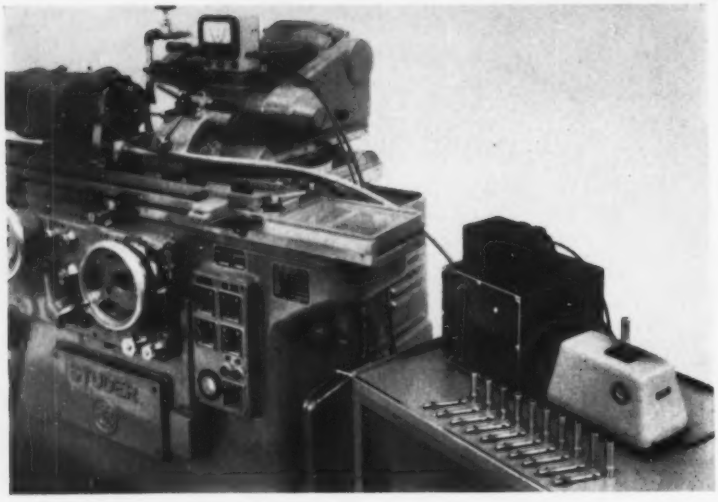


Studer universal grinding machine introduced by Cosa Corporation

Universal Grinding Machine with Match-Grinding Attachment

A Studer RHU-450 high-precision universal grinding machine is now available to the American market from the Cosa Corporation, New York City. This equipment is hydraulically controlled and equipped with special electronic measuring controls. It is designed particularly as a production machine for match-grinding, internal and external grinding, and superfine and lap-grinding.

The electronic measuring controls include a Movolimit electronic size-control instrument for accurate grinding to a predetermined diameter from a master part or the first work-piece in the run; and a Deltalimit match-grinding instrument for match-grinding a shaft to fit a specific bore diameter.

The Deltalimit equipment is especially effective for grinding servo valves, plungers and barrels, and other mating parts where tolerances must be held to millionths of an inch. The finished bore is placed on the measuring arbor of the Interlimit internal measuring unit. For automatic match-grinding of the shaft to the bore, the grinding machine movements are controlled as a function of the bore diameter and the desired, pre-set clearance. Any deviation in the bore from nominal diameter is automatically compensated for.

On Movolimit equipment the grinding operation is controlled automatically in relation to the work-piece diameter, independently of grinding-wheel wear. The machine will grind work-pieces up to 18 inches between centers with an 8-inch swing. Work-spindle speed is infinitely variable from 30 to 650 rpm. Accessories include cam- and taper-grinding attachments.

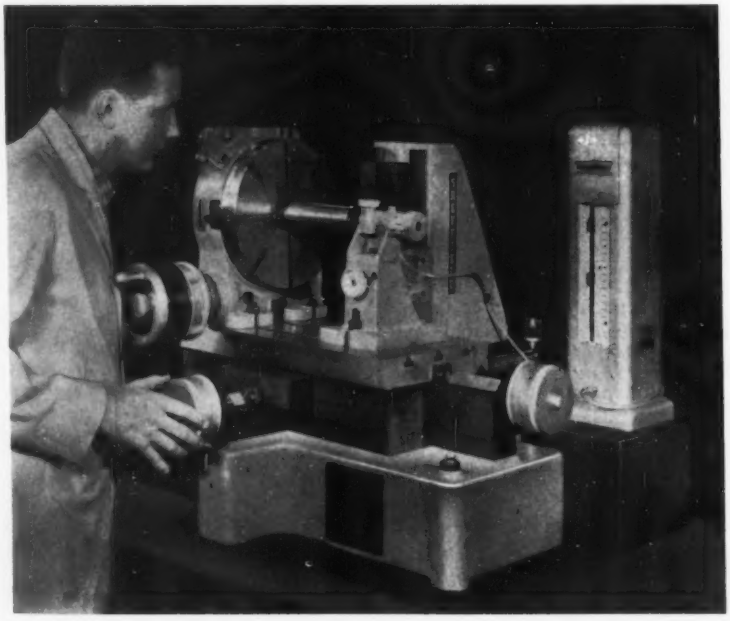
Circle Item 595 on postcard, page 173

Sheffield Measuring Machine for Inspection of Three-Dimension Cams

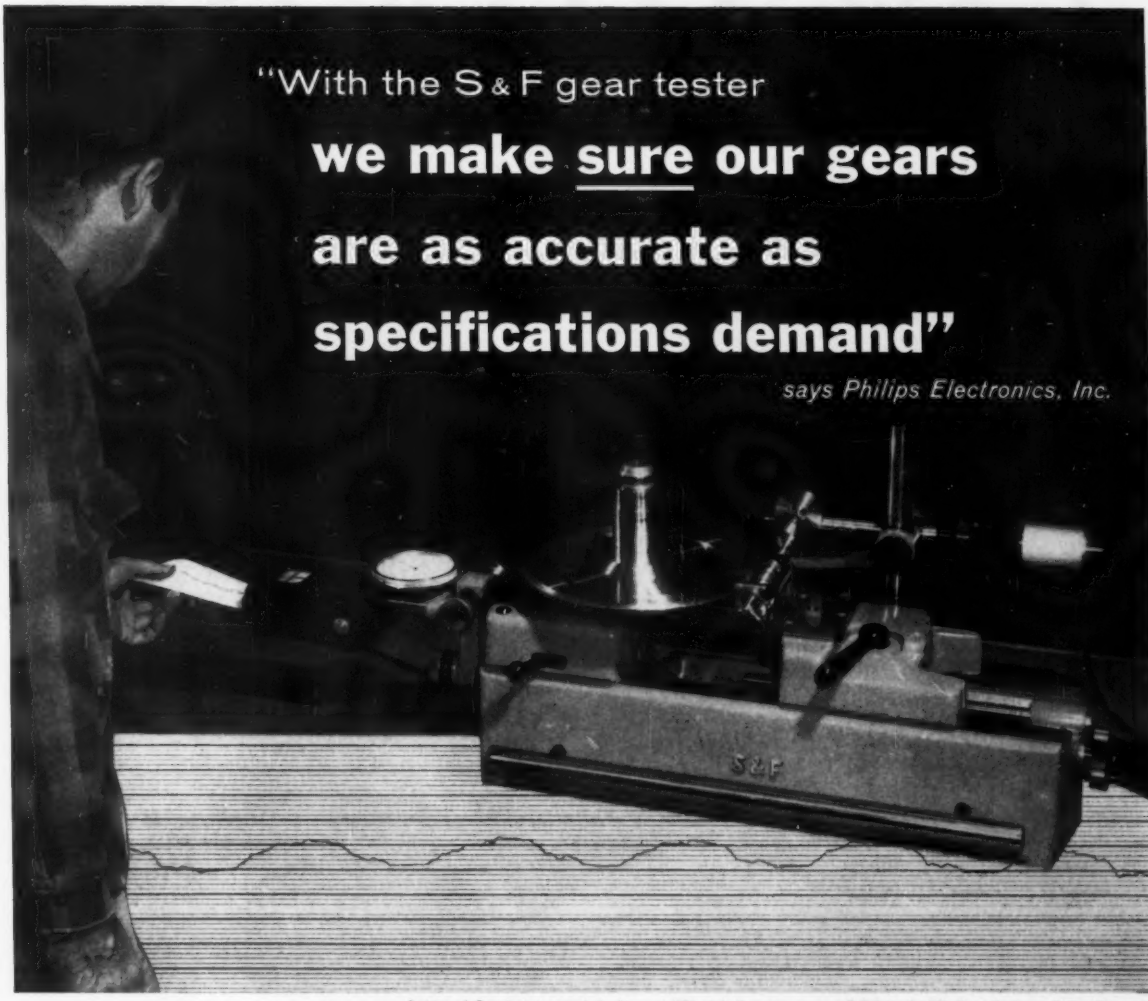
A Precisionaire toolroom and laboratory measuring machine for inspecting the contour of two- and three-dimension cams is available from the Sheffield Corporation, Dayton, Ohio, a subsidiary of Bendix Aviation Corporation. Three-dimension cams up to a 3-inch radius size with a length of 6 inches can be inspected on this equipment which requires a bench space only 32 by 26 inches. Irregular-shaped parts requiring precise measurement can also be inspected.

A cam to be inspected is located between the table and tailstock centers. After the proper angular and axial adjustments are made with the rotary table and axial micrometer, the indicator stylus is brought into contact with the cam at the specified starting point by adjusting the front micrometer until the float in the Precisionaire column is at zero. Following this, the cam is advanced the specified amount to the next inspection point by means of the angular and axial adjustments. Then, the float in the column instrument is returned to zero by adjusting the radial mi-

(*Continued on page 182*)



Three-dimension cam-measuring machine developed by the Sheffield Corporation



Section of Graphotest record checking out 10" pitch diameter gear on S & F Model 110 Gear Tester at Philips Electronics.

there's no gear tester as accurate as the S & F—

GUARANTEED TO REPEAT WITHIN .00001"!

The engineer sets down his gear specs. The gear hobber goes to work. The gear tester checks out the finished gear. Perfect! *But is it?*

The plain fact is that the gear tester is all too often the weakest link in the chain. And until the S & F came along, manufacturers had no sure way of knowing their "precision" gears were as precise as they were supposed to be.

No such doubt exists at Philips Electronics. Shown above is a special spur gear used on the Norelco Goniometer. Its basic pitch diameter is 10", diametral pitch 36", number of teeth 360. Print specs call for a total composite error on 360° rotation of .001" and the gear must be concentric within .0003", total indicator reading. Pretty close tolerances for a gear of this size.

Has Philips achieved it? They're never in doubt. "We are now able to verify the accuracy of our gears to an extent never before possible," say Philips engineers.

And this experience is typical of hundreds of precision-minded plants all over the country who are producing gears that *must* check out—and do—on S & F Testers.

We'd like nothing better than to show you how the S & F is revolutionizing gear checking. Or talk to any users near you. We'll send you their names.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN

COMPANY, INC.

42 Exchange Place, Jersey City 2, New Jersey

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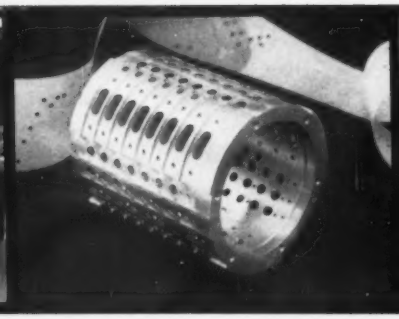
ACCURACY



MACHINING TIME WAS CUT 50% for 10-piece lots of these gear boxes, by changing from manual to tape control. Locations made automatically under tape control are accurate to .0001".

30-HOUR JOB DONE IN 7½, when this precision computer part was machined under Numerical Control. This job involved precision machining at 566 separate locations.

1429 HOLES WITHOUT ERROR, an almost impossible job under manual operation, was completed under Pratt & Whitney Numerical Control with estimated time savings of 41%.

ASSURED...

"P&W NUMERICAL CONTROL HAS PROVED IT WILL IMPROVE **MACHINE UTILIZATION*** 100% AND ELIMINATE ERRORS," says "Jake" Jaeger

** (Time spent cutting metal)*

Mr. J. J. ("Jake") Jaeger, Vice President and Chief Engineer of Pratt & Whitney's Machine Tool Division, states, "Reports from more than 35 successful installations in the field and experience in our own manufacturing conclusively prove that P&W Jig Borers with Numerical Control represent a truly significant advance in metalworking. Users, which include both the giant corporations and shops with less than 10 men, are realizing time savings from 2-to-1 to 6-to-1 – depending on the complexity of the parts – and in addition have improved their MACHINE UTILIZATION time 100%. With this great increase in productivity, the jig borer has truly become a production machine. Used, for example, in our own manufacturing of components, the need for expensive jigs is eliminated, engineering changes are simple and inexpensive – and every production part has the toolroom precision of an original jig.

ADDITIONAL ECONOMIES THROUGH SCRAP ELIMINATION . . .

"With all machine positioning made automatically under Numerical Control, scrap losses from human errors in positioning are eliminated. Freed from blueprint calculating, the operator can concentrate on his primary job – making chips. The result is more and better work, with less fatigue.

VERSATILITY UNLIMITED

"The P&W Jig Borer has also proved that it can handle efficiently and economically an almost unlimited variety of jobs – one-piece jobs, extremely complex jobs, or lot production – in fact, any job that requires drilling, reaming, tapping or boring holes, or milling slots or surfaces."

Summing up the importance of Numerical Control, "Jake" Jaeger continues, "No one can *afford* to overlook the ability of this equipment to increase machine tool utilization and effect economies in his own operations." Experience has proved the truth of this statement, so act today to get all the facts on P&W Numerical Control. Write now for your free copy of Circular No. 609. Pratt & Whitney Company, Inc., 12 Charter Oak Boulevard, West Hartford, Conn.

PRATT & WHITNEY

FIRST CHOICE FOR ACCURACY

MACHINE TOOLS • GAGES • CUTTING TOOLS

AUTOMATICALLY POSITIONING WORK ACCURATE TO .0001", the P&W Numerically Controlled Jig Borer combines toolroom precision with production-line speed and economy.

SETTINGS ACCURATE TO 5 SECONDS OF ARC are made automatically by the P&W Rotary Table with Numerical Control. Automatic positioning speeds work, eliminates human errors.

PROFILE MILLING ENTIRELY UNDER TAPE CONTROL, the P&W Numeric-Keller produces irregular shapes without the need for any template or model. Accuracy is unusually high.

crometer at the front of the machine and the micrometer read to determine the amount of deviation.

Radial and axial movements can be made to an accuracy of 0.00001 inch and angular positions to within plus or minus 6 seconds of arc throughout 360 degrees.

Circle Item 596 on postcard, page 173

Hammond Abrasive-Belt Polishing Head

A UP-2 abrasive-belt polishing head designed to make it possible to polish and buff economically on one machine has been introduced by Hammond Machinery Builders, Inc., Kalamazoo, Mich. This head is built for use on the Hammond OK, RL, and ROL polishing lathes. It is said to offer all the advantages of a contact wheel, free belt, and platen grinding and finishing machine.

The UP-2 head is recommended for light- to medium-duty polishing operations and can be furnished on either or both sides of the lathe. It takes up very little floor space. The operator need take only one step in moving from the polishing to buffing position.

A spindle speed of 1750 rpm gives the polishing belt a speed of 5500 sfpm (surface feet per minute) when using a contact wheel 12 inches in diameter. The upper idler pulley assembly can be adjusted to use belts 52 to 90 inches in length. Belt widths range from 1 to 2 1/2 inches. A belt guard and dust scoop with exhaust outlet are standard equipment.

Circle Item 597 on postcard, page 173

Package Filter for Cutting Oils or Coolants

The M. J. French Co., Inc., Rochester, N. Y., has announced a package filter designed for use in gun-drilling, thread-grinding, honing, and other precision machining, or as a small-shop central filtration system for cutting oils or water-soluble coolants. Five sizes provide flow rates from 10 to 150 gpm (gallons per minute) depending on the type and viscosity of the oil. This system includes a pressure filter, a three-compartment filter tank, filter pump mounted and piped, and other accessories, such as variable-volume pumps.

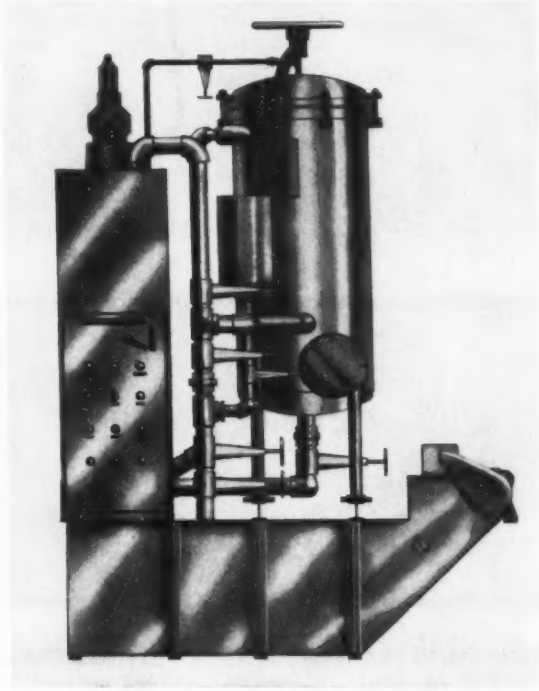
Circle Item 598 on postcard, page 173

Thermalair respirator

Thermalair Respirator for Use Against Excessive Heat

A Thermalair respirator which provides protection against excessive heat has been announced by the American Optical Co., Safety Products Division, Southbridge, Mass. It was developed to protect workers where intense heat endangers health—such as in kilns and ovens where temperatures range

Abrasive-belt polishing head brought out by Hammond Machinery Builders



Package filter for cutting oils announced by M. J. French Co., Inc.

JONES & LAMSON MACHINE COMPANY

the man who needs a new machine tool is already paying for it

"See what the boys in the front room will have"

It's not hard to guess what they'll "have", if they can get it. *Every* management is looking for new, soundly-planned proposals which promise better productivity, lower costs, increased profits.

Where do such proposals come from?

Properly, they should come from people like yourself; the top production and plant operating men who know production best.

In order to convince the front office, to win them over to a new, improved production program, you *must* have the facts; the latest information on how to cut costs through new methods, new tooling, new equipment.

It's safe to say that whenever a sound new production proposal is rejected, it's because somebody either didn't have the *right* facts to present, or didn't present them in a convincing way.

We can give you some real help. We'll supply the facts about J & L equipment and what it can do; and we'll show you how to organize these facts to make up a really well-planned, convincing replacement program.

Write today for information that could make your job a much better one. Jones & Lamson Machine Company, Dept. 710, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

from 150 to 300 degrees F. It can also be used for emergency entrances in furnaces and boilers.

The respirator can be used with heat-reflective clothing in temperatures up to 300 degrees F. A special aluminized hood has been added to the company's line of heat-reflective clothing to accommodate the respirator.

The Thermalair is a simple device capable of exchanging overheated air for respirable air. The respirator cartridge contains a metal-screen heat exchanger which absorbs heat when the user inhales. Absorption is great enough to cool incoming air to approximately body temperature. As the user exhales, the stored hot air is forced out and the cycle repeats.

The Thermalair is re-usable—it can be washed and sterilized. The entire unit weighs only 6 ounces and has a low breathing resistance —only 0.2 inches of water at 85 liters per minute air flow.

Circle Item 599 on postcard, page 173

Heavy-Duty Production Tool Grinder

The first lot of Kempsmith heavy-duty production tool grinders of the type shown in the illustration were designed and built by the Kempsmith Machine Co., Milwaukee, Wis., for an automobile-engine manufacturer who operated large batteries of turning equipment. These machines solved his tool-bit grinding problem so satisfactorily that additional machines were ordered to service his other plants. In one installation, two grinders with relatively unskilled operators regularly ground from 1300 to 1500 tool bits per day. The tool bits ranged in size from 3/8 by 3/4 inch to 1 inch by 2 inches and removed 1/8 to 5/8 inch of stock.

The grinder spindle is mounted on three large precision anti-friction bearings in front and a double anti-friction precision bearing in the rear. It is driven by V-belt from a 3-hp motor located in the base. The wheel-mounting end of the spindle is massively designed to furnish rigid support for the grinding wheel. Inexpensive, metal-backed cup wheels are used. Tool bits to be ground are held in a double-swivel, right-angle holder which permits grinding at all angles. This tool-bit holder is mounted on a cradle which pivots on a large steel guide. The cradle is rocked to and fro past the face of the grinding wheel and by turning the handwheel is fed toward the wheel. A complete coolant system and adequate guards are provided. The cradle is regularly arranged for hand rocking but power-rocking equipment is available at a slight additional cost. With minor modifications this machine can be used for production face-milling of small non-ferrous metal parts.

Circle Item 600 on postcard, page 173

Portable Welding-Gun Unit

A mobile welding-gun unit has been developed recently by the Federal Machine & Welder Co., Warren, Ohio. This equipment is designed for general-purpose spot welding of parts. It features a lightweight welded-steel cart which facilitates moving the unit from one weld position to another. The welding transformer, heat regulator, electronic controls, air controls, air valve, and flexible cables with air-operated gun are all mounted on the cart.

Circle Item 601 on postcard, page 173

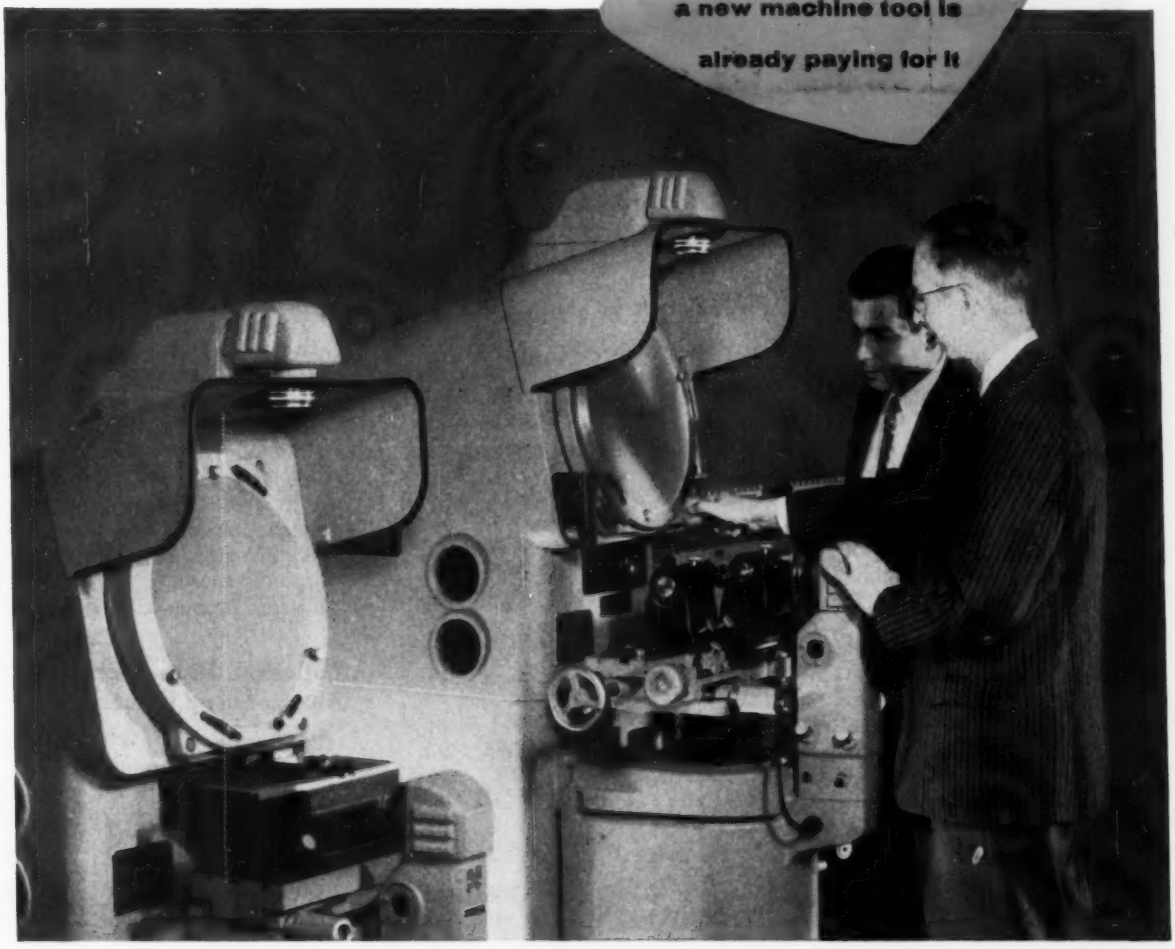
(This section continued on page 186)

Kempsmith heavy-duty production tool grinder

Federal mobile general-purpose welding-gun unit

JONES & LAMSON OPTICAL COMPARATORS

the man who needs a new machine tool is already paying for it



This is what you should demand in an Optical Comparator

Optical inspection and measuring equipment offers fast operation, extreme accuracy and tremendous versatility. When buying a comparator, be sure you *get* these benefits:

1. Specifically designed *projection* lens system (not just an adaptation of *other* types of lenses).

2. Ball and roll type supported measuring tables (they offer top speed and accuracy).

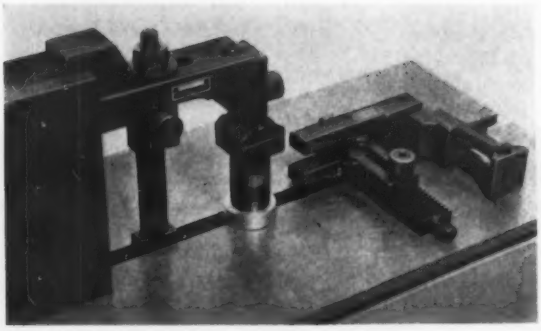
3. Table assemblies so designed that simple changes can be made in your own plant. (You can change a basic *comparison* machine over to one for universal *measuring* applications, at low cost.)

4. Measuring facilities that offer direct readings without computation. (You save a lot of time, minimize human error, assure accuracy.)

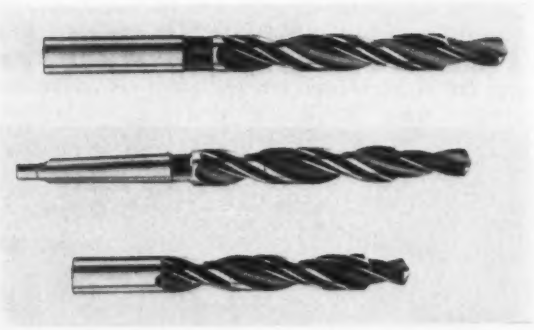
5. Solid mechanical design throughout. (You can't inspect anything very accurately if it's moving.)

Jones & Lamson Optical Comparators and Measuring Machines give you all these features, plus many more. They are explained in detail in our new catalog. Write for a copy today. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools



Starter set of Hi-Lo clamps and accessories



Subland drills recently announced by Mohawk Tools, Inc.

Hi-Lo Clamps Starter Set

A starter set of Hi-Lo clamps containing all the parts needed to make up a clamp to suit any clamping range from 3/8 inch to 11 inches has been brought out by the Hi-Lo Products Co., Detroit, Mich. The set includes U-clamps in two adjustable ranges, extensions, and a gooseneck adapter. Both the bolt and the heel-block assemblies are adjustable. Either range of U-clamp can be used by itself, or with extensions or the gooseneck adapter. With the T-nut on the bolt, this clamp can be used on slotted tables. Without the T-nut, the bolt can be screwed directly into bolsters. Adjustment of the Hi-Lo clamp is simple. A patented slot-and-shoulder arrangement permits serrations to be disengaged with just a one-fourth turn of a knurled knob. Hi-Lo clamps are also available in complete sets.

Circle Item 602 on postcard, page 173

Mohawk Subland Drills

Mohawk Tools, Inc., Montpelier, Ohio, recently announced the availability of subland drills, like those illustrated, in all practical standard sizes for drilling prior to tapping. This line is available from local distributor or plant stocks in all tap sizes from 10-24 to 5/8-18 NC and NF, in three step lengths and three shank styles. These standard sizes were selected to best suit the industry-wide acceptance of unified standards and hole tolerances and to provide a faster, more accurate, and economical method of simultaneously drilling and chamfering clean, concentric holes for better tapping.

Circle Item 603 on postcard, page 173

"Navkut" Cutoff Saw

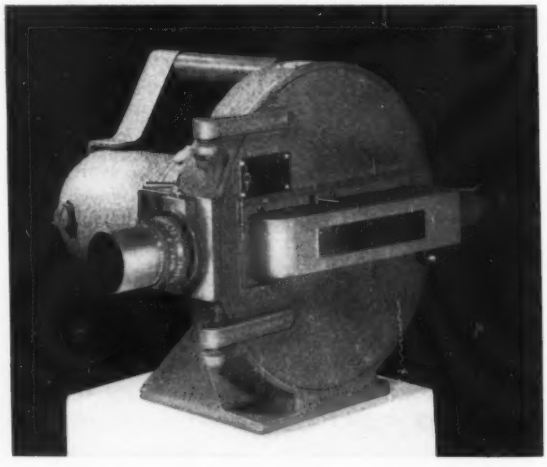
A new cutoff saw, designated "Navkut," which is capable of length accuracy and cut parallelism within limits of 0.003 inch has been placed on the market by Navan Products, Inc., Los Angeles Calif. Special machining and checking methods permit final alignment of cut to within 0.001 inch in all planes of the cutting operation. This saw will cut accurately most ferrous and non-ferrous metals, plastic, and wood, using only two different blades and a fixed spindle speed.

Circle Item 604 on postcard, page 173

Wollensak High-Speed Motion-Study Camera

A 16-millimeter "Fastax" high-speed motion picture camera designed to stop motion that is too fast for the human eye to see has been announced by the Wollensak Optical Co., Rochester, N. Y. This camera has a new high-index glass, two-sided prism shutter and a new drive mechanism. It will

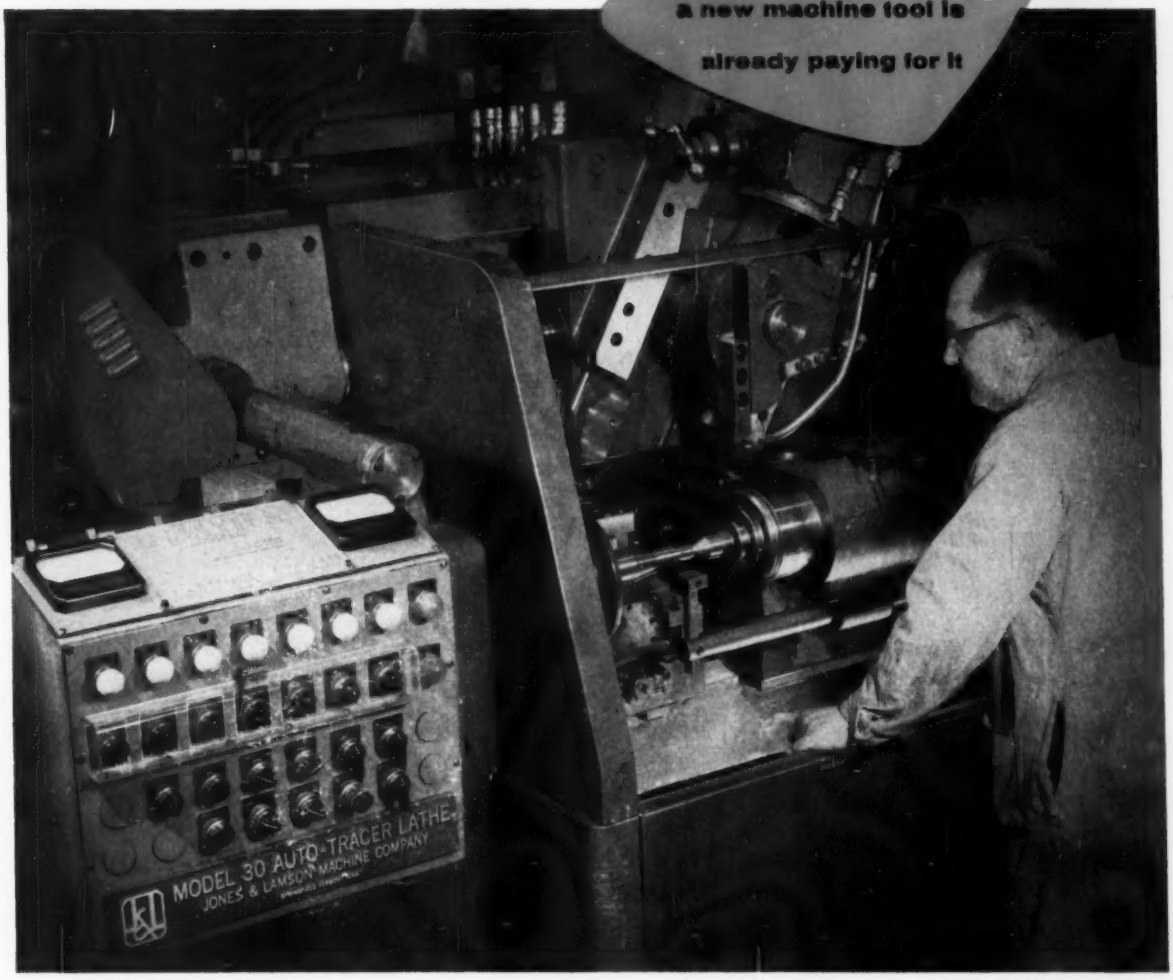
Cutoff saw introduced by Navan Products, Inc.



Wollensak high-speed motion-study camera

JONES & LAMSON MACHINE TOOLS

the man who needs a new machine tool is already paying for it



Brand-new! A fully automatic tracing lathe

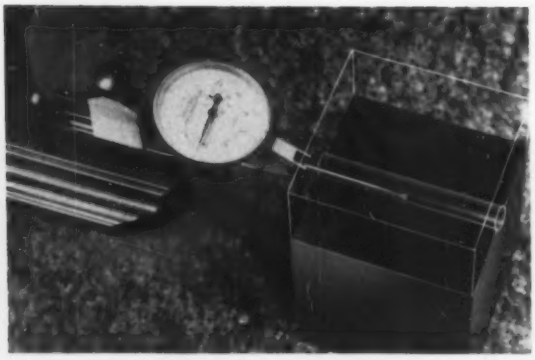
This new J & L Model 30 Fully Automatic Tracing Lathe combines a number of flexible designed features, *and it's competitively priced.* The basic J & L ingredients of extra ruggedness and extreme precision are apparent throughout. (Note the unusual solidness of the tracing slide, for instance.) Specifically, it offers 1. *Fast and flexible set-ups* which are extremely simple, and accessible to the operator, 2. *Compact and convenient controls* for push-button programming of the automatic cycle, 3. *Automatic speed and feed changes* during a cut, 4. *Work handling facilities* that can be either automatic or manual (there's plenty of room for chip disposal, too).

In addition, this machine will accommodate any one of three different rear slides. It also offers a choice of two different headstocks. Moreover, the stylus and template are high and dry.

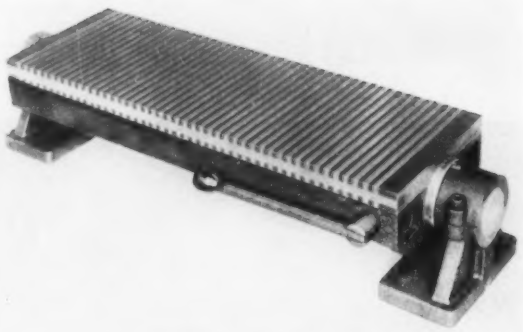
Details and specifications are contained in our brochure No. 5810. Write for your copy. Jones & Lamson Machine Company, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

For more data, circle this page number on inquiry card



Test indicator with long ball-tip contact made by Federal Products Corporation



Swivel-base permanent magnetic chuck announced by O. S. Walker Co., Inc.

record action on film so that it can be projected later at the conventional speed of sixteen frames per second for analysis and study. The camera uses a continuously rotating two-sided prism synchronized with film movement and can take pictures from 150 to 6000 per second. No additional motors are required for these speed ranges.

This new high-speed "Fastax" camera (Model WF-3T) takes 100-foot daylight loading spools and is particularly useful where motion studies of short duration are required. The camera has a viewfinder, timing light, and cutoff switch. It supplements but does not replace the standard 8- and 16-millimeter four-sided prism cameras, which give frame rates up to 16,000 pictures per second.

Circle Item 605 on postcard, page 173

Federal Test Indicator with Extra-Long Contact Arms

Four models have been added to the recently announced line of Series L Testmaster indicators made by the Federal Products Corporation, Providence, R. I. To provide long range and high magnification, these models are equipped with extra-long contact arms for deep-hole exploration in jig-borer and surface-plate applications. The 0.080-inch ball-tip contact arms are either 1.446 or 1.497 inches long, depending on the model. All have 0.0005-inch graduations with a total range of 0.080 inch (eight revolutions) and are available in either horizontal or perpendicular styles with either regular or large (1 1/2-inch diameter) dials.

For more positive holding these units are equipped with integral dovetails, rather than an end-mounted holding bar, and can be used with any of the holding attachments designed for Federal's Series M Testmasters. These are known as Models L-15, L-16, L-19, and L-20.

Circle Item 606 on postcard, page 173

Swivel-Base Permanent Magnetic Chucks

The O. S. Walker Co., Inc., Worcester, Mass., has announced a line of permanent magnetic chucks with swivel bases for holding work that requires all kinds of flat or angular machining operations. The design allows the chuck and work-piece to be tilted 45 degrees right or left of center. The exact position is set directly from an integral graduated dial. In the "Off" position, the chuck is completely demagnetized. The table face of the model illustrated is 8 by 24 inches. A complete range of sizes is available.

Circle Item 607 on postcard, page 173

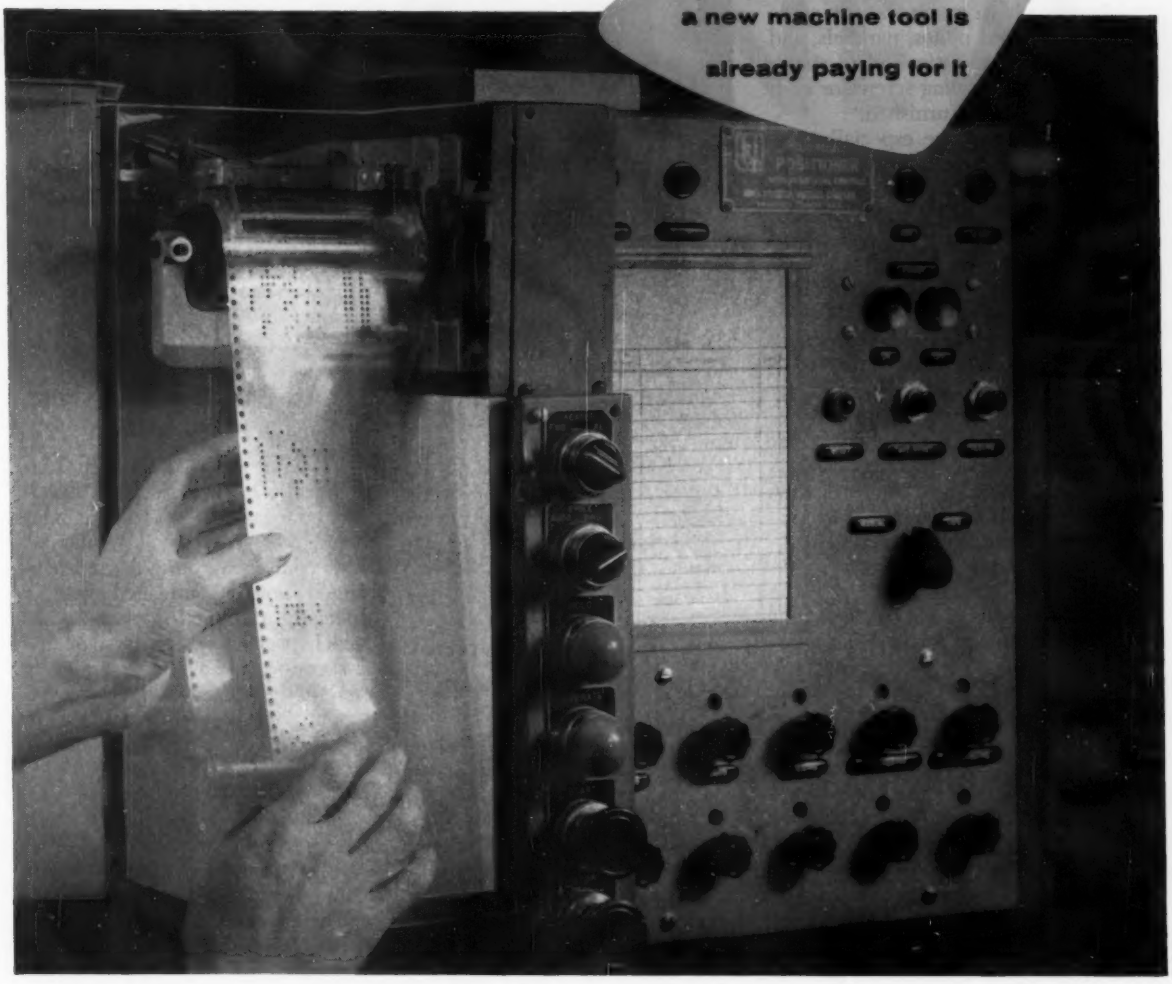
P & W Precision Granite Surface Plates

The Pratt & Whitney Co., Inc., West Hartford, Conn., has announced a line of precision granite surface plates and accessory equipment to supplement the

Pratt & Whitney precision granite surface plates and accessory equipment

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it



Numerical Control . . . what's it worth?

What *about* numerical control: is it all it's cracked up to be? The answer, in a word, is "yes". Here's why. With numerical control, the *big* factor is *flexibility*. Tape or numerical programming can be employed economically for medium or small lot production, even down to *single pieces*. Accuracy is also increased. For instance, Jones and Lamson tape controlled positioning units hold tolerances of ±.001 on applications for punching, drilling, boring or similar operations where point-to-point positioning is mandatory. Machine set-up and change-over become primarily an office procedure. Numerical control of machining operations eliminates the need for cams, templates, even prototype parts and special fixtures. It results in greater machine utilization, and speeds actual machining. Lead time is reduced, and because human error is largely eliminated, accuracy is improved.

Any way you look at it, numerical control has come of age. It's being used more and more, simply because it produces better, at lower costs. For detailed information, write Jones & Lamson Machine Company, Dept. 710, 512 Clinton Street, Springfield, Vermont.

Turret Lathes • Automatic Lathes • Tape Controlled Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

company's extensive line of gaging products. The granite products range in size from small toolmakers' flats to large surface plates 7 by 14 feet and include accessory items such as: granite layout, angle and T-slotted plates, parallels, and straightedges. Surface plate stands with either leveling screws or casters can also be furnished.

These plates are especially well adapted for precision checking of parts, instruments, and assemblies and for use in laying out designs, as well as for engineering work.

The precision granite plates and accessories are composed of California black granite that has been normalized and stress-relieved by nature through many centuries. They are said to hold their accuracy permanently with practically no maintenance. They repel moisture, shed abrasives, resist erosion, will not warp, and are washable with soap and water. They are relatively unresponsive to temperature changes, and are nonmagnetic.

A certificate of inspection is furnished with each plate, guaranteeing its over-all autocollimator accuracy and plotting the deviation from a true plane in millionths of an inch for each position inspected.

Circle Item 608 on postcard, page 173

Brown & Sharpe Micrometer for Measuring Hot Metal

A rolling-mill micrometer, No. 18, designed for measuring hot sheet or strip metal as it rides off the rolls has been developed by the Industrial Products Division of Brown & Sharpe Mfg. Co., Providence, R. I. This rugged tool, with a 1-inch measuring range and 0.001-inch graduations, is equipped with plastic handle and large-winged locking screw to permit its use even while the operator is wearing large protective gloves. Rugged construction enables the micrometer to withstand rough treatment in many steel mill and other applications.

B & S micrometer for measuring hot metal

Circle Item 609 on postcard, page 173

High-Speed Belt-Driven Wheel-Heads

The grinding of small holes at precise surface speeds without high-frequency generating equipment is now possible with belt-driven wheel-heads developed by the Heald Machine Co., Worcester, Mass. These interchangeable cartridge type wheel-heads develop spindle speeds of 45,000 to 100,000 rpm for grinding small-diameter holes where the surface speed of the grinding wheel is critical. This equipment is especially useful in small shops, making it possible for them to precision-grind certain types of small work where close size control, finish, and wheel life are important, but where the limited production does not permit the purchase of conventional high-production precision equipment.

Two interchangeable spindle cartridges are available. One operates at speeds of 45,000, 52,000, and 60,000 rpm, the other, at 70,000, 85,000, and 100,000 rpm. The three separate speeds for each cartridge are obtained by changing pulleys. Both cartridges have spindles arranged to accommodate mounted-point wheels.

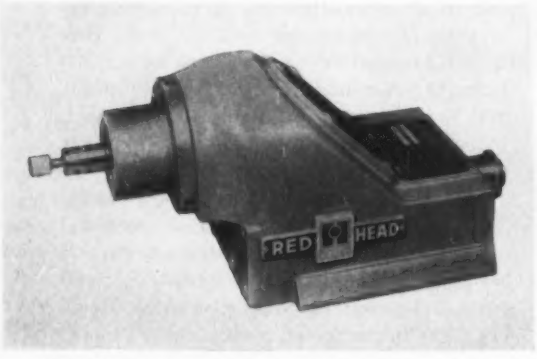
Circle Item 610 on postcard, page 173

"Cartrilamp" with Coated Optical Flats

The Cartriseal Corporation, Lincolnwood, Ill., has recently developed a new monochromatic light source known as the "Cartrilamp." This completely portable, self-contained unit is furnished with a specially designed carrying case which protects it against damage. Inspection speed and accuracy is said to be considerably improved when the Cartrilamp is used in conjunction with the new, coated "Cartriflats."

An exclusive feature of the Cartrilamp is the placing of the work on top of the flat, instead of beneath the flat. This is said to eliminate much waste motion.

The easy-to-read viewing mirror is located inside the cabinet where it is shielded from the annoying glare of outside light. Cartriflats measure accuracies of less than five



Belt-driven wheel-heads for high-speed precision grinding made by Heald Machine Co.

"Cartrilamp" and "Cartriflat" optical flats for inspecting surface flatness

introducing a

NEW

OLOFSSON

HEAVY DUTY PRECISION BORING MACHINE

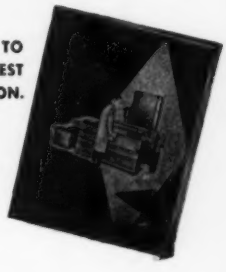
Designed for better precision finishing...semi-finishing...and roughing of large, bulky parts

This newest in the line of Olofsson Precision Boring Machines, the Model 22, is designed for more profitable heavy-duty rough and finishing boring, facing, chamfering, turning and grooving operations. Put one to work . . . and profit potential goes up. Because of the versatility of its new design, operating costs go down.

MODERN, WITH 22 QUALITY-DESIGN FEATURES, the Olofsson Model 22, weighs a hefty 7,600 lbs., untooled; and incorporates such design features as:

- *Extremely low ratio, height to width, of spindles to ways.*
- *Hardened and ground Alloy Steel flat and vee ways.*
- *Extra-large fixture mounting provides maximum stability for mounting large work pieces.*
- *Integral chip chutes completely surround any fixture tooling.*

WHATEVER YOUR PRODUCTION REQUIREMENTS. IT WILL PAY YOU TO FULLY INVESTIGATE THE MODEL 22. CONTACT YOUR NEAREST OLOFSSON REPRESENTATIVE. Or, if you prefer, write direct to OLOFSSON.



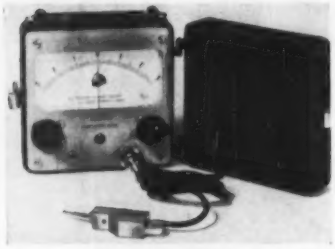
THE OLOFSSON CORPORATION

2729 LYONS AVENUE, LANSING, MICH. *Phone:* IV anhoe 4-5381

MANUFACTURERS OF PRECISION BORING AND SPECIAL MACHINERY

millionths of an inch, and can be obtained in sizes smaller than 10 inches if desired. They can be had with center holes for inspecting shoulders on extended shafts.

Circle Item 611 on postcard, page 173



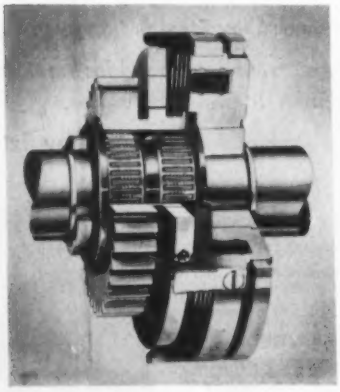
Transistorized Indicator

MICROtrol 170 transistorized indicator recently added to the line of industrial products introduced by the Airborne Instruments Laboratory, a division of Cutler-Hammer, Inc., Mineola, N. Y. This rugged battery-powered portable unit is housed in a gasketed, die-cast metal case for maximum utility under the most severe environmental conditions. Long-life standard mercury cells ensure reliable operation. Indicator provides full-scale ranges of 0.0006 (magnification 7700×) and 0.006 (magnification 770×) inch.

Circle Item 612 on postcard, page 173

I-T-E Electro Clutch

Electro clutch that provides for instantaneous push-button or automatic programming control of machine tool feeds and speeds made by Transformer and Rectifier Division, I-T-E Circuit Breaker Co., Philadelphia, Pa. This clutch is capable of operation in oily locations. Being extremely small in size, it is ideal for integrating with drives and gear trains inside machinery housings. It is only one of a line developed to facilitate complete push-button control and automation of machine tools. Thirteen compact magnetic clutches of this line are used in the Fosmatic jig-borer described and illustrated in January 1958 MACHINERY, page 183.



Circle Item 613 on postcard, page 173

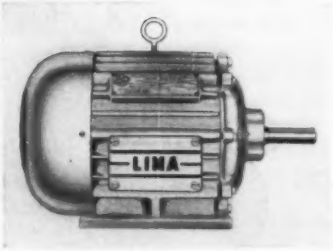
Rollpin Kit

Packaged assortment of "Rollpins" or spring pins for metalworking industries made by the Elastic Stop Nut Corporation of America, Union, N. J. The plastic box of this No. 300 Kit contains over 700 carbon-steel spring pins in conveniently arranged compartments. The kit contains eleven sizes of pins ranging from 1/16 to 1/2 inch in diameter. The individual pieces range from 3/16 inch to 3 1/4 inches in length and include a "mix" or group of sizes believed to be most practical for machine shops, repair work, and prototype or design groups. The "Rollpin" is a slotted and chamfered tubular spring pin heat-treated to achieve maximum strength. Pin diameter is slightly larger than the hole into which it is inserted, causing pin to exert constant pressure against the wall of the hole to prevent loosening.

Circle Item 614 on postcard, page 173

Lima Explosion-Proof Motor

Type EX explosion-proof motor incorporating latest technical advances, brought out by the Lima Electric Motor Co., Inc., Lima, Ohio, a subsidiary of Consolidated Diesel Electric Corporation. It has received Underwriters' Laboratories approval for Class I Group D and Class II Groups F and G service. Now supplied in new NEMA Standard Frames, Nos. 182 through 326U. These frame assignments accommodate standard ratings of 1 through 40 hp, either 3 or 2 phase, in all commercial frequencies and voltages below 600. Lima Type EX motors are approved for use in locations where hazardous gasoline, petroleum, naphtha, alcohols, acetone, lacquer solvent vapors, and natural gas are present. Built to NEMA dimensions throughout, each motor meets or exceeds the standards of performance set up by NEMA for re-rated motors.



Circle Item 615 on postcard, page 173

Airco Welding Helmet

Wide-vision welding helmet offering a 120-degree increase in the welder's field of vision announced by the Air Reduction Sales Co., a division of Air Reduction Co., Inc., New York City. Lens area measures 4 1/2 by 5 1/4 inches, a valuable asset to those who must wear bifocal or trifocal prescription glasses beneath the helmet.

FULL ELECTRICAL CONTROL

...and other outstanding features for

FASTER, BETTER, LOWER COST Boring, Facing, and Turning

with the ALL-NEW

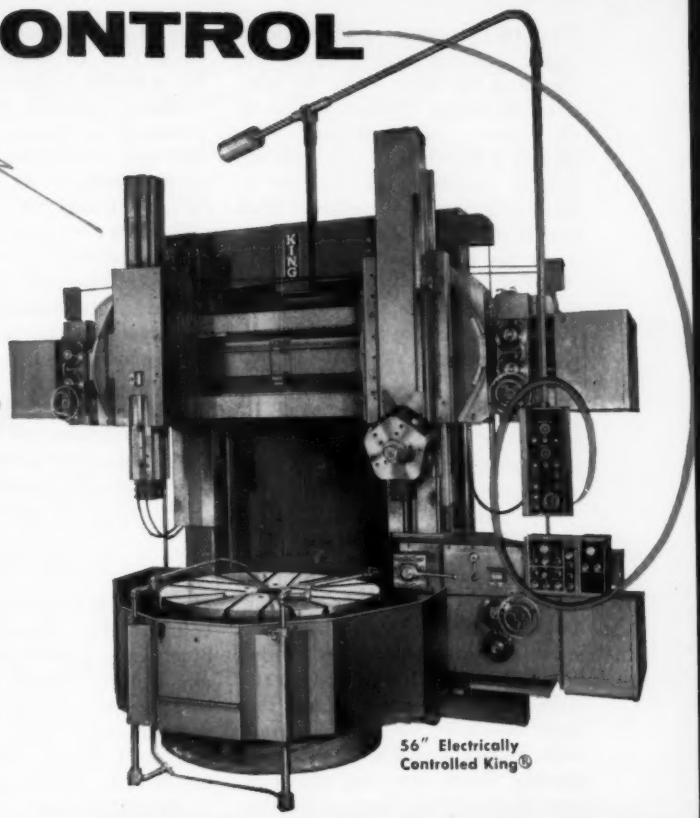
KING

Here is boring mill control manipulation cut to a bare minimum . . . all controls *electrical* . . . all controls literally at the operator's *fingertips!*

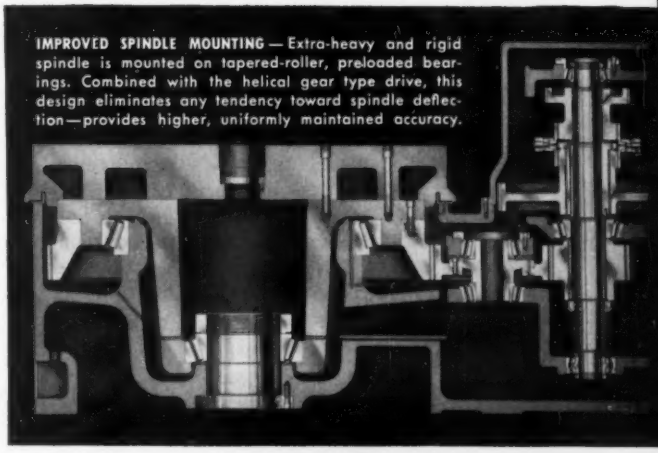
On these new KING® Vertical Boring & Turning Machines, direction of head movements is by simplified "up-down" and "in-out" switches; spindle speeds and feeds—both in expanded ranges—are pre-selective from direct-reading dials. The new KING is huskier and more powerful, too. Increased machine rigidity and higher horsepowers take *full advantage* of the capabilities of modern cutting tools.

The new KING will bring to your operation, as it is bringing to so many others, all-important competitive advantages in faster set-up . . . faster operation . . . higher, uniformly maintained accuracy . . . greatly increased productivity . . . *profit-making performance.*

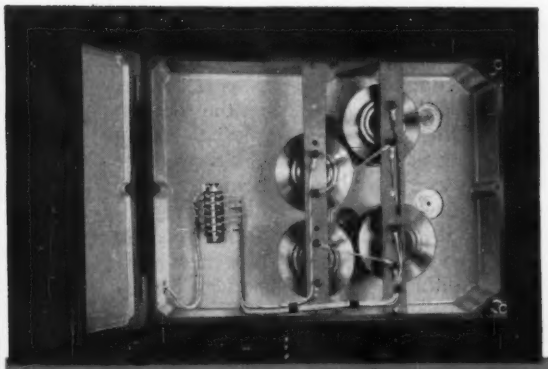
For complete details see your authorized King Distributor, or write us direct.



56" Electrically Controlled King®



IMPROVED SPINDLE MOUNTING — Extra-heavy and rigid spindle is mounted on tapered-roller, preloaded bearings. Combined with the helical gear type drive, this design eliminates any tendency toward spindle deflection—provides higher, uniformly maintained accuracy.



MAGNETIC-CLUTCH TRANSMISSION for feed rods. Pushbutton operated. Instantaneous engagement and disengagement of feeds assured. No periodic adjustment needed . . . clutches are easily removed for maintenance.

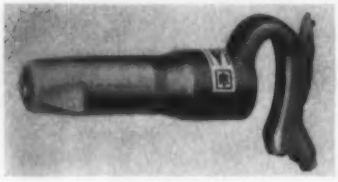
UNIT CONSTRUCTION OF DRIVE Extra-rugged housing provides increased rigidity for mounting of shafts. Heat-treated alloy gears, and shafts mounted in anti-friction bearings, used throughout. Drive removable as a unit for easy maintenance.

KING VERTICAL BORING & TURNING MACHINES

American Steel Foundries
KING MACHINE TOOL DIVISION
1150 Tennessee Avenue, Cincinnati 29, Ohio

The two models, one with a curved bottom going under the chin and the other with the bottom extending straight down to the chest, accommodate lens shades 3 through 14, all meeting federal specifications. Helmet is constructed of vulcanized fiber and is of seamless design.

Circle Item 616 on postcard, page 173



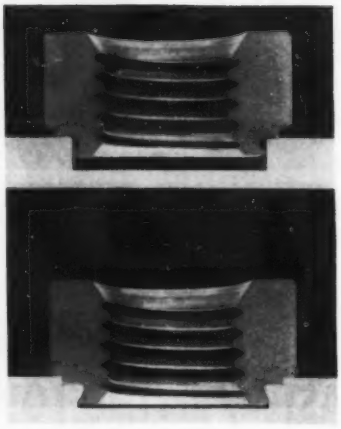
Shock-Absorbing Chipping Hammer

Chipping hammer with a rubber-bonded "shock-absorber" nozzle and a controlled power valve to allow tailoring the power of the hammer to exactly suit the job requirement, announced by the Ingersoll-Rand Co., New York City. It is claimed that this tool absorbs chisel vibration; provides new comfort and efficiency for the operator; substantially reduces the noise level; and eliminates breakage of parts caused by improper operation. In addition, the tool has a newly designed valve which makes it possible to adjust the power of the hammer to the material and to varying requirements of the work. Four power sizes—"L" (light cut), "N" (normal cut), "E" (extra cut), and "S" (super cut)—are available for each hammer size. There are five hammer models, thus making a total of twenty graduated power hammers from which to select the tool most appropriate to the requirements of each operator and his particular job. Conversion of a particular size hammer to any one of the four power ratings is easily done.

Circle Item 617 on postcard, page 173

Swage Nut

High-strength SPS swage nut developed by Standard Pressed Steel Co., Jenkintown, Pa. This nut can be quickly installed in thin sections without special tools and without discoloring or buckling the fastened material. In the upper cross-section view the nut is shown inserted in hole ready for swaging. Ordinary hydraulic or pneumatic presses—even portable rivet setters—serve satisfactorily as installation equipment. Lower view shows how pressure of flat parallel plates against the assembly displaces metal around the edge of the hole, forcing it into retaining groove in neck of nut.

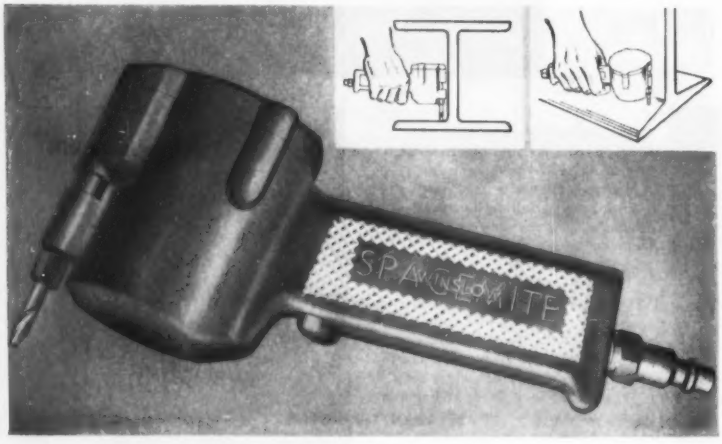


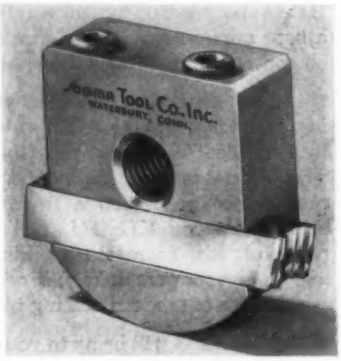
Circle Item 618 on postcard, page 173

"Spacemite" Drill Motor for Use in Limited Access Areas

Drill motor called the "Spacemite" announced by the Winslow Product Engineering Corporation, Arcadia, Calif. This tool is designed for hand drilling of holes within 1/4 inch of bulkheads and other obstructions and within a 9/32-inch radius in 90-degree corners. The rugged construction permits overload conditions up to 1/2-inch reamers or drills. A 1/4-inch air line with a pressure of 90 psi is recommended as a suitable air-supply source. The drill has a free spindle speed of 3000 rpm.

Circle Item 619 on postcard, page 173





Somma Tool-Bit Holder

"Quick-Form" tool-bit holder designed for fast setups on small-lot runs recently announced by the Somma Tool Co., Waterbury, Conn. With this holder it is a simple matter to hand or surface grind the form in standard high-speed steel or carbide tool bits; or even circular grind, using the Quick-Form holder as a fixture. Holder is secured to the toolpost the same as a form tool, fitting front or rear slides for forward or reverse motion. It is not necessary to remove the circular form toolpost when using tool bits on short runs. Supplied in three sizes with either B & S or American Standard Threads.

Circle Item 620 on postcard, page 173

One

PROFIT PICTURE

after another

—with

SPIRAL POINT*

Every day, all kinds of drilling installations are proving that Spiral Point transforms a standard twist drill into a cost-reducing, precision tool.

On this alloy steel Universal Link, a manufacturer of hydraulic equipment ELIMINATED TWO MACHINING OPERATIONS—*the result of Spiral Point's self-centering drilling action!*

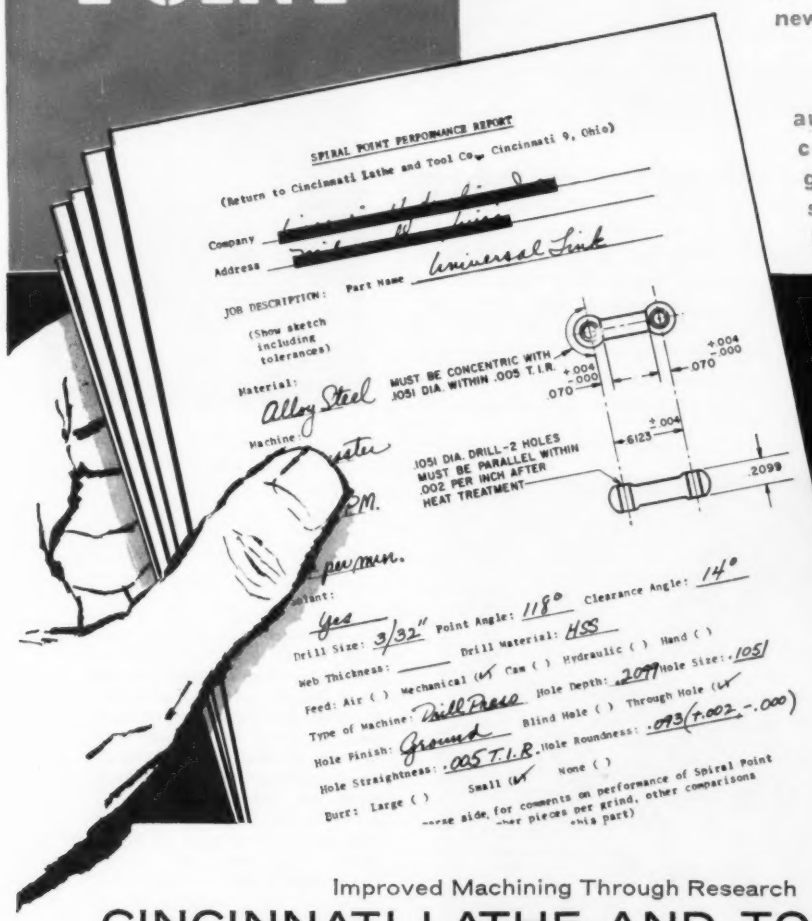
To hold concentricity and parallelism, previous methods of machining required spot milling both holes with a special end mill, then drilling and reaming undersize, with a final grinding operation after heat treatment to complete the part.

With a Spiral Point grind using 118° point angle and 14° clearance on $\frac{3}{32}$" HSS drills, tolerances were held consistently. Only drilling and finish grinding after heat treatment were needed.

Why not convert the twist drills in your plant into precision Spiral Points? The new Cincinnati

SPIROPOINT® DRILL SHARPENER

automatically applies this cost-saving new point geometry in a matter of seconds! Ask your C L & T Dealer, or write us direct.


SPIRAL POINT PERFORMANCE REPORT
(Return to Cincinnati Lathe and Tool Co., Cincinnati 9, Ohio)
Company
Address
JOB DESCRIPTION: Part Name Universal Link
(Show sketch including tolerances)
Material: Alloy Steel
MUST BE CONCENTRIC WITH .1051 DIA. WITHIN .005 T.I.R.
.070
.1051 DIA. DRILL-2 HOLES MUST BE PARALLEL WITHIN .002 PER INCH AFTER HEAT TREATMENT
.6123
.2099
Drill Size: 3/32" Point Angle: 118° Clearance Angle: 14°
Web Thickness: Drill Material: HSS
Feed: Air ( ) Mechanical (✓) Cam ( ) Hydraulic ( ) Hand ( )
Type of Machine: Drill Press Hole Depth: .2099 Hole Size: .1051
Hole Finish: Ground Blind Hole ( ) Through Hole (✓)
Hole Straightness: .005 T.I.R. Hole Roundness: .093 (+.002 -.000)
Burr: Large ( ) Small (✓) None ( )

* With CINCINNATI's Spiral Point, new drill point geometry, you get accurate hole size — straighter, rounder, cleaner holes — and you eliminate secondary operations; maintain hole-positioning accuracy without costly guide bushings or pre-centering; get more holes per grind.

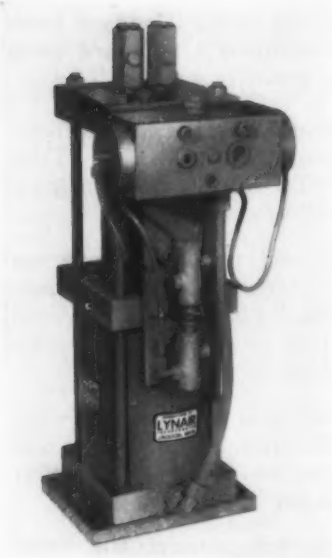
Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

For more data, circle this page number on inquiry card



Lynair Automatic Air Booster

Automatic air booster made by Lynair, Inc., Jackson, Mich., to boost air-line pressure automatically in surge tanks and die cushions. It will maintain constant air pressure on press clutches, furnish high-pressure air for testing refrigeration devices, or for any other application where the air-line pressure must be increased. The device is made ready for use by simply connecting an air-line pressure pipe to the master control valve and to the booster.

Circle Item 621 on postcard, page 173

"Magic Chuck" for Quick Tool Changing

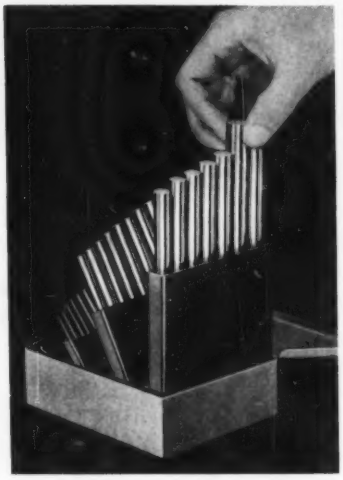
"Magic Chuck" designed for quick tool changing which gives multiple-spindle versatility to single-spindle drilling machines, announced by Seibert & Sons, Inc., Chenoa, Ill. With this holder it requires only seconds to change from one tool to another. This feature makes the new chuck especially valuable where such operations as drilling, reaming, and tapping are done in succession. Raising the locking ring releases the collet with its tool. A new collet is then inserted and is locked in place by letting the ring drop down on the chuck.

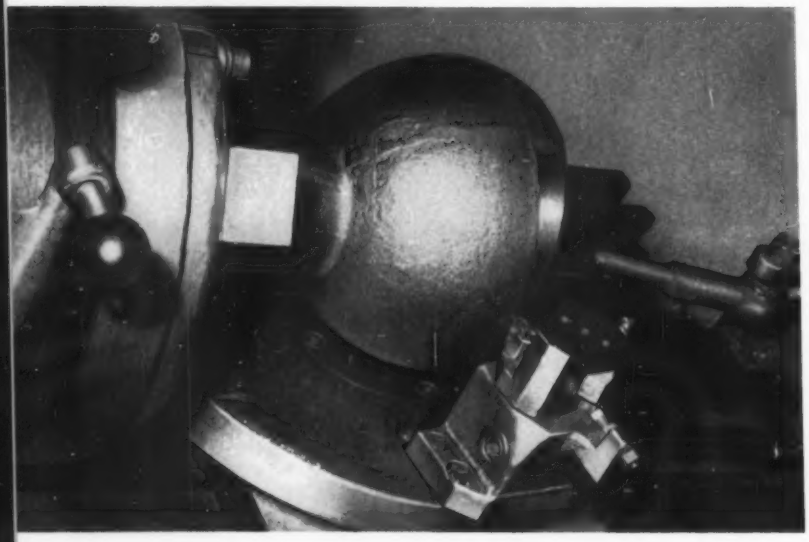
Circle Item 622 on postcard, page 173

Hardened and Ground Drill and Reamer Blanks

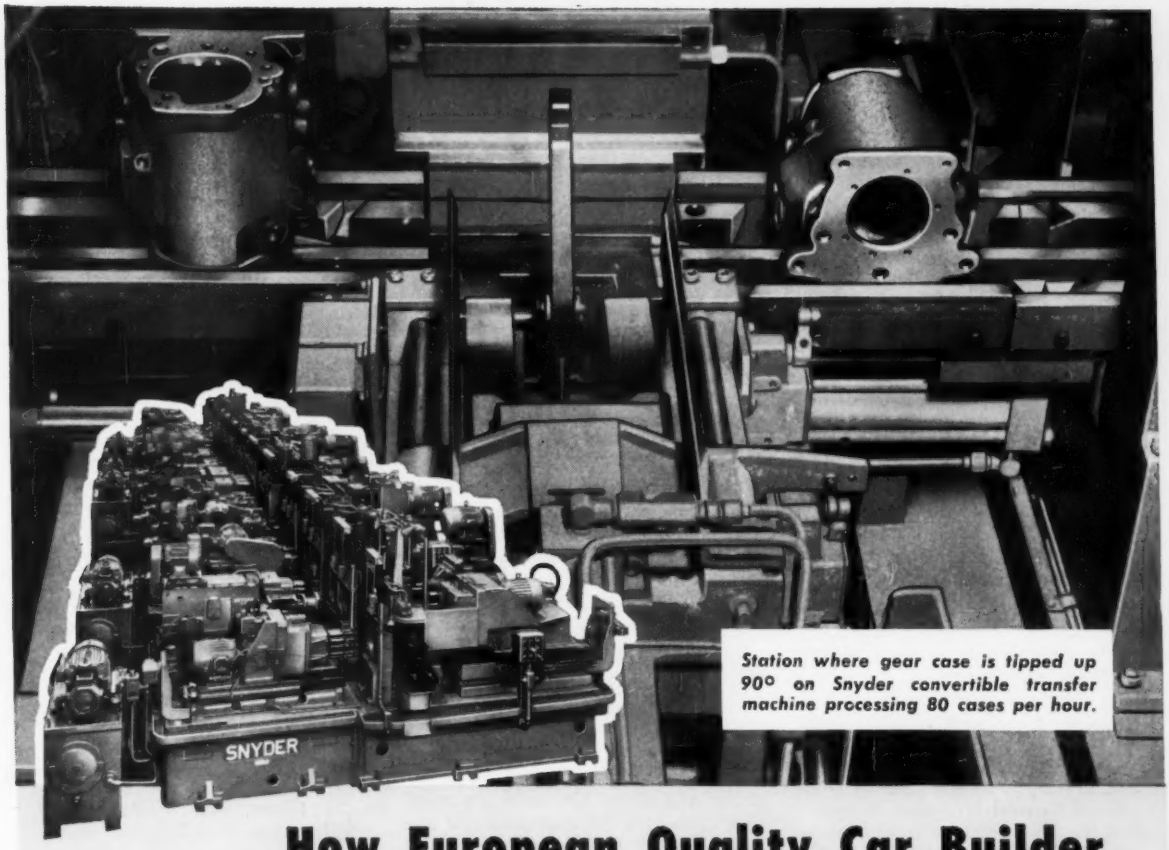
Expanded line of hardened and ground high-speed steel drill and reamer blanks which feature new close-tolerance limits over the complete range of standard stock sizes from 0.0135 through 1.000 inch in diameter, announced by the Ace Drill Corporation, Adrian, Mich. Jobber-length drill blanks are now available in all standard wire sizes from No. 1 through No. 80, letter sizes from A through Z, and fractional sizes from 1/64 inch through 1/2 inch in diameter in step series of 1/64 inch. These are cut from mill-length bars of high-speed steel.

Circle Item 623 on postcard, page 173





The spherical surface of a trunnion socket steel forging for a front-wheel axle is rough-turned on a Gisholt turret lathe having a radius attachment on its bed. An interrupted cut is taken with a positive-rake, square throw-away carbide insert (Kendex K4H). The sphere has a radius of 5 1/4 inches, and is turned at 194 rpm, with a feed of 0.020 inch per revolution and a 3/16-inch depth of cut.



Station where gear case is tipped up 90° on Snyder convertible transfer machine processing 80 cases per hour.

How European Quality Car Builder Snyderizes for the Soaring Sixties

This new 53-station transfer machine combines special purpose efficiency with high convertibility for later changes. Part orienting devices enable Snyder to utilize standard horizontal way-type units to drill, spotface, chamfer, ream, line-ream, mill and bore this cast iron standard gear transmission case on all faces. The cases are turned 90° at the thirteenth station and tipped up 90° at the thirty-eighth station, which eliminates vertical machining units. The part is specifically located on faces not subject to future design changes, thus reducing future capital expenditure.

★ ★ ★

Let us show *you* how to SNYDERIZE FOR THE SOARING SIXTIES for more efficient parts handling, gaging, assembly and machining. Send or phone for new brochure with resume of Snyder machines engineered for profit improvement.

Standard Features of Snyder Machines

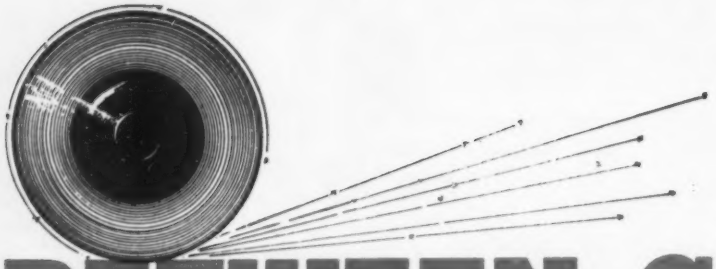
1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground steel ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Automatic lubrication.
5. J.I.C. Standards throughout.
6. Electrical interlocks and full depth circuit throughout.
7. Panels equipped with SNYDER CIRCUIT SLEUTH.

SNYDER CORPORATION

(Formerly Snyder Tool & Engineering Company)

3400 E. LAFAYETTE—DETROIT 7, MICHIGAN
Phone: LO 7-0123

For more data, circle this page number on inquiry card



By E. S. Salichs

BETWEEN GRINDS

Atomic Punch Line

Vice Admiral Hyman G. Rickover, designer of American nuclear weapons, states in his book "Education and Freedom": "We have put tremendous emphasis on executive ability, on organizational training, without realizing that the most powerful executive is inferior to one talented engineer."

Tennis, Anyone?

The Lobber, a ballistic cargo missile, developed by the Convair Division of General Dynamics Corporation for the Army, is a revolutionary "first," according to *Industrial Research Newsletter*. It can be used for hurtling rations, medicine, communications gear, and ammunition to troops over the next hill or hundreds of miles distant. The "offensive lob," a tennis stroke, now takes on meaning as a military stroke.

Thin Golden Melody

Gold alloy strip, only 0.000080 inch thick, has been developed for the high-fidelity recording industry by the American Silver Co. The strip is forty times thinner than a human hair, which makes us glad that hair doesn't come that thin.

Metallic Mail

An aluminum foil envelope, 11 inches long and a real eye-opener, containing a letter also printed on foil, is being used by the Chase Brass & Copper Co. to announce that certain of its warehouses now carry in stock Kaiser aluminum mill products.

A Pup Talk?

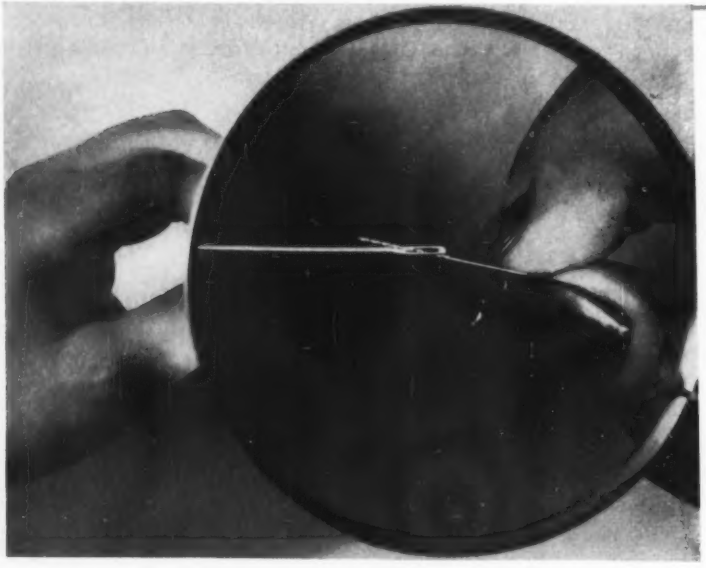
Sign seen in the new corrosion laboratory of the Carpenter Steel Co.: "If you growl all day, naturally you feel 'dog-tired' at night."

Sign vs. Siren

If the electronic highway control system now under consideration becomes a reality, one device will be a sign that flashes "Slower Please," setting off automatically a warning to speeding cars. Takes the words right out of the mouth of the little woman, setting off automatically an argument.

Hot Sun Not Always Fun

In an effort to protect pilots facing direct sunlight high above the earth in the future, two scientists described, at the annual ASME meeting, a device they are developing. A material simulating human skin is laid over a metal cylinder. Temperature is controlled both above and below the "skin" surface, enabling designers to produce proper clothing and atmosphere for those exposed to this type of heat.



TO SHOW, NOT SEW—By way of demonstrating the tiny precision drills manufactured by the Super Tool Co., Detroit Division of Van Norman Industries, this picture was taken. The drill is being inserted through the eye of an embroidery needle by a lady whose nails were magnified eight times along with the needle and drill. Solid cemented carbide is used in these drills, which are being produced down to 0.024 inch in diameter

Helixform*—a new method for bevel gear production!

The new No. 112 Hypoid Helixform Gear Finisher assures improved quality and increased production on spiral bevel and hypoid non-generated ring gears up to 10½" in diameter, and 2½ DP such as employed in passenger car axles.

The Helixform Cutting Method used on this machine offers these advantages:

Conjugate tooth surfaces, minimized gear development, complete control of tooth bearing, and greater adjustability in final assembly.

We will be glad to send a bulletin giving further details on request. Ask for literature on the No. 112 Hypoid Helixform Gear Finisher and the companion No. 112 Hypoid Gear Rougher. Write for it today.

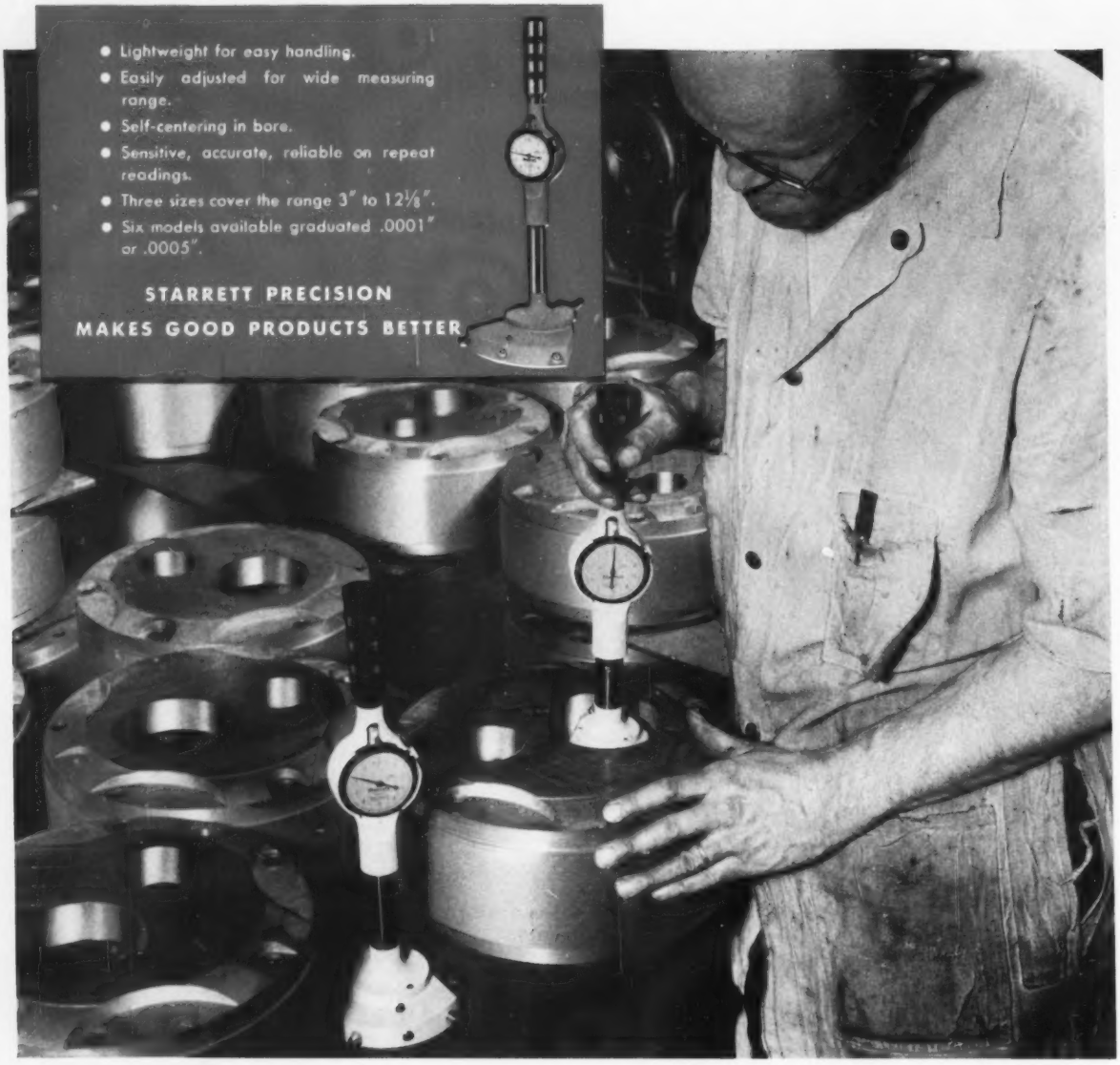
*Trade-Mark

GLEASON WORKS

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

69-A

For more data, circle this page number on inquiry card


• Lightweight for easy handling.
• Easily adjusted for wide measuring range.
• Self-centering in bore.
• Sensitive, accurate, reliable on repeat readings.
• Three sizes cover the range 3" to 12⅛".
• Six models available graduated .0001" or .0005".
STARRETT PRECISION
MAKES GOOD PRODUCTS BETTER

New STARRETT No. 84 series DIAL BORE GAGES

Lightweight, wide range gages . . . *sensitive, accurate, easy to handle*

Light and easy to handle because the gaging head, indicator housing and knurled handle are aluminum . . . readily adaptable to a wide range of bore sizes by means of interchangeable range extension screws that are adjustable and positive locking (no other adjustment necessary) . . . self-centering because the gaging head rides on two spring-loaded centralizing plungers plus the range screw . . . sensitive and accurate because the separate gaging contact is lightly spring-loaded to insure high repeatability.

Three sizes of these new Starrett No. 84 Series Dial Bore Gages will handle all bore diameters from 3 inches to 12⅛ inches (3"-5 3/16", 5"-8⅛", 8"-12⅛"). Available with Starrett high precision-low friction Dial Indicators reading in ten-thousandths or half-thousandths. Range screw, gaging contact and centralizing plungers normally furnished in hardened and tempered tool steel. Also available carbide tipped on special order.

Your nearby Industrial Supply Distributor will gladly demonstrate new Starrett No. 84 Series Dial Bore Gages . . . show you how they will save time, cut costs and improve accuracy on bore inspection and measurement. Call him for quality products, dependable service . . . or write Starrett for complete information. Address Dept. D, The L. S. Starrett Company, Athol, Massachusetts.

Starrett®

DIAL INDICATORS AND DIAL GAGES

World's Greatest Toolmakers

PRECISION TOOLS • DIAL INDICATORS • STEEL TAPES • GROUND FLAT STOCK • HACKSAWS • HOLE SAWS • BAND SAWS • BAND KNIVES

Visit the Starrett Exhibit—Booth 632—Western Metal Exposition

AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—3

Approved as American Standard October 29, 1958

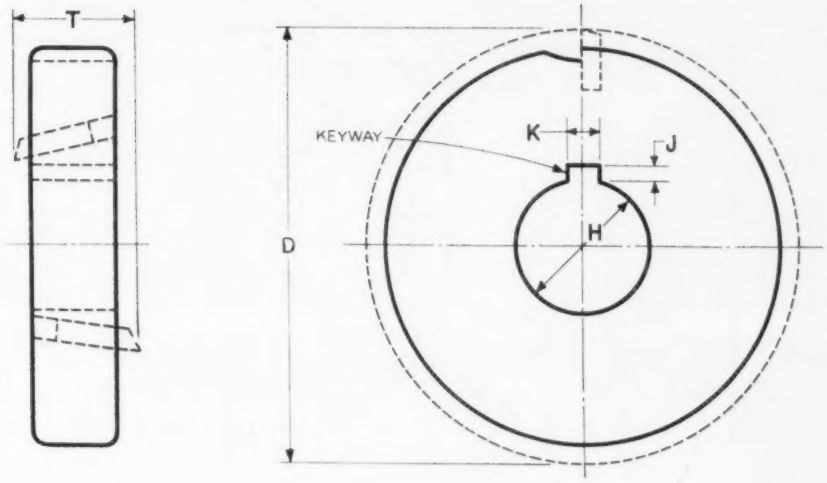


Table 3. Cutter Bodies for Staggered-Tooth Side Mills or Slotting Cutters with Inserted Blades

General Dimensions			Keyway Sizes
Diameter of Cutter D	Width of Cutter T	Diameter of Hole H	
4	3/4, 7/8, 1	1 or 1 1/4	All keyway dimensions to be in accordance with American Standard (ASA B5.3)
6	3/4, 7/8, 1	1 1/2 or 2	
8	7/8, 1, 1 1/4	1 1/2 or 2	
10	1, 1 1/4	2 or 2 1/2	
12	1, 1 1/4, 1 1/2	2 or 2 1/2	

All dimensions given in inches.

Tolerances will be given in Table 6 to be published in a succeeding data sheet.

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—4

Approved as American Standard October 29, 1958

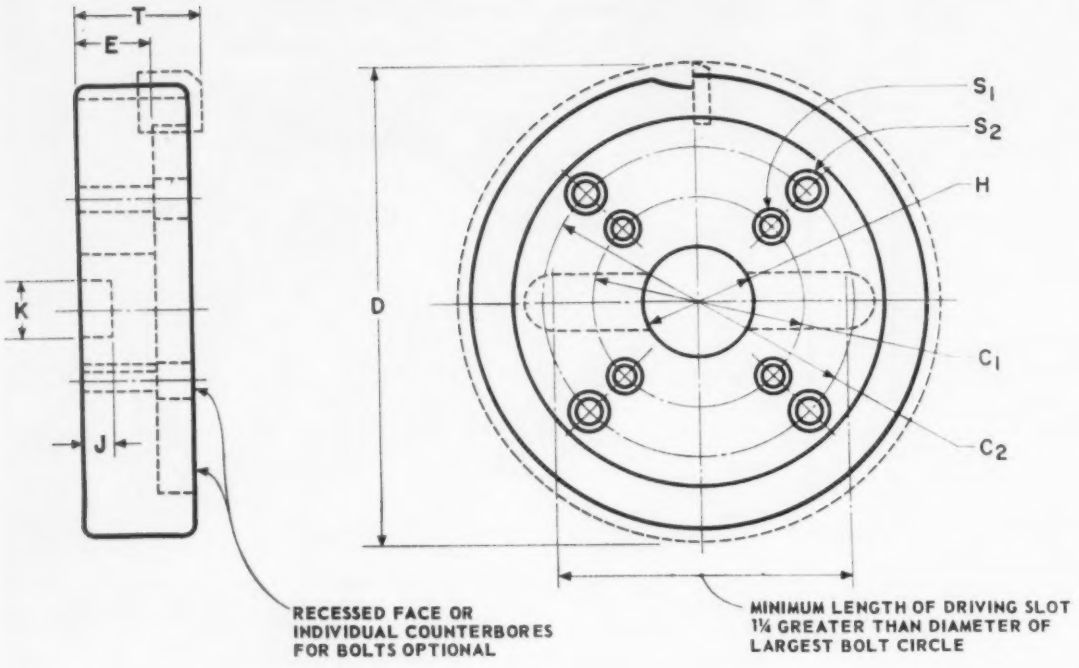


Table 4. Cutter Bodies for Face Mills with Inserted Blades Series Flat Back

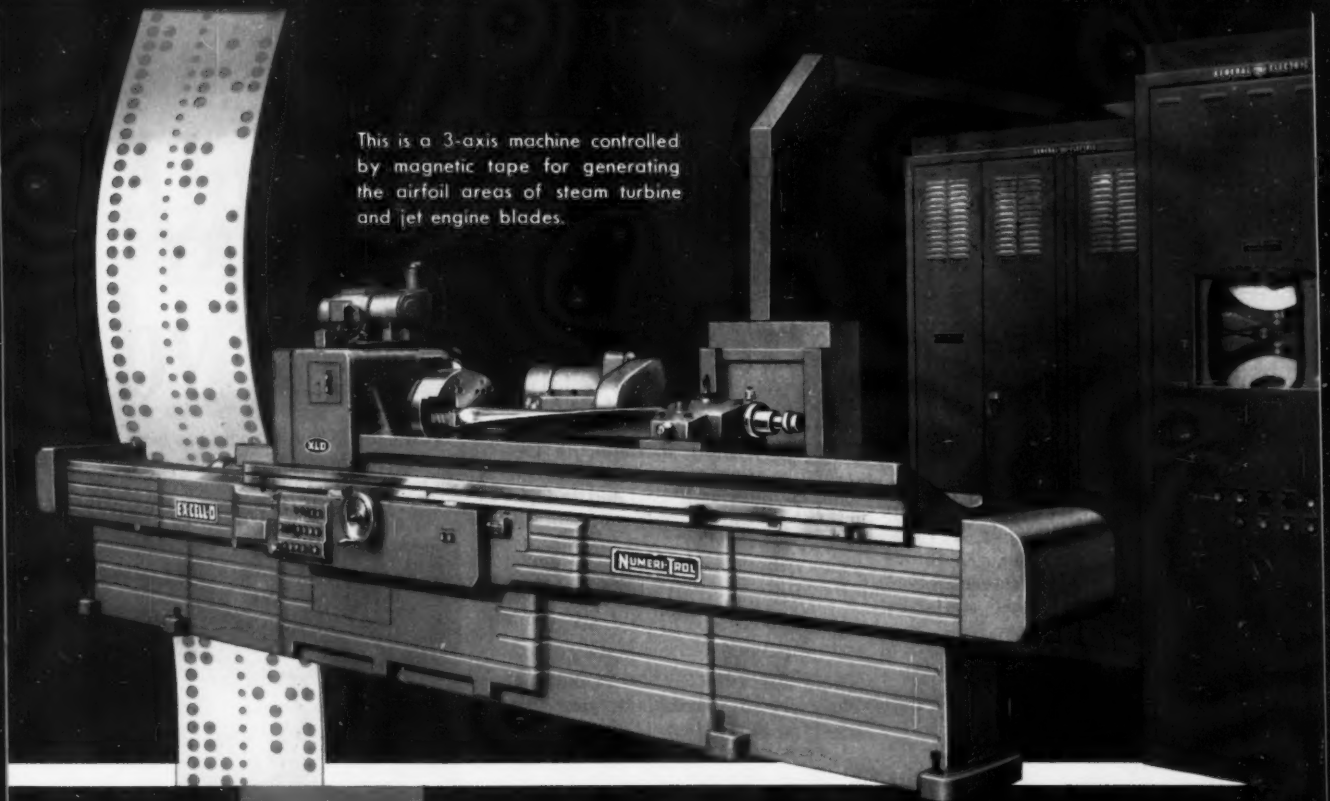
General Dimensions			Driving Slot		Bolt Holes						
Diameter of Cutter	Width of Cutter	Diameter of Hole	Width	Depth	Length of Bolt Holes Min.	Diameter of Circle		Drill and Counterbore Min.		Drill and Counterbore Min.	
D	T*	H	K	J	E	C_1	C_2	S_1		S_2	
8	2 1/4 to 3 3/8	2 1/2	1	17/32	1 1/4	4		21/32	29/32		
9	2 1/4 to 3 3/8	2 1/2	1	17/32	1 1/4	4		21/32	29/32		
10	2 1/4 to 3 3/8	2 1/2	1	17/32	1 1/4	4		21/32	29/32		
12	2 1/4 to 3 3/8	2 1/2	1	17/32	1 1/4	4		21/32	29/32		
14	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16
16	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16
18	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16
20	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16
22	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16
24	2 1/2 to 4 1/2	2 1/2	1	17/32	1 1/4		7			25/32	1 1/16

All dimensions given in inches.

*Optional with cutter manufacturer within range given.

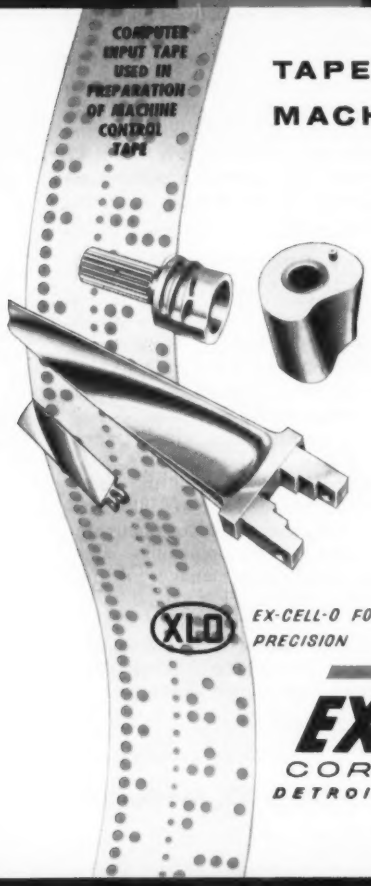
Tolerances will be given in Table 6 to be published in a succeeding data sheet.

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.


This is a 3-axis machine controlled by magnetic tape for generating the airfoil areas of steam turbine and jet engine blades.
EX-CELL-O
NUMERI-TROL

NUMERI-TROL

59-3



TAPE CONTROLLED PRECISION PROFILING MACHINES BY EX-CELL-O

FIRST to provide 360° work rotation for 3-dimensional machining of complex parts

FIRST to combine grinding, dressing and dressing compensation with milling

Numeri-Trol puts a new dimension into machining. Lead time goes down, tooling costs and machining time are cut in production of prototypes and complicated precision parts. Lateral movement of the work head and transverse travel of the cross slide combine with rotary work feed to permit milling and finish grinding impossible or uneconomical by ordinary standards. Wheel dressing and dressing compensation are fully tape-controlled. Numeri-Trol machining includes rotary and longitudinal milling with automatic work feed and 360° indexing.

Have a part that is costing too much to make? Find out how Numeri-Trol can produce it—economically! See your Ex-Cell-O Representative or write direct.

XLO *EX-CELL-O FOR PRECISION*

EX-CELL-O CORPORATION *Machinery Division*
DETROIT 32, MICHIGAN

EX-CELL-O PRECISION PRODUCTS INCLUDE: MACHINE TOOLS • GRINDING AND BORING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • TORQUE ACTUATORS • THREAD AND GROOVE GAGES • GRANITE SURFACE PLATES • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

News OF THE INDUSTRY

California and Arizona

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announced the appointment of three district sales managers at its Los Angeles, Calif., steel service plant. They are FREEMAN X. KINZIE, LOREN B. CLAY, and HARRY M. CASSEL. As former sales managers of stainless steel, tubing and cold-finished steel bars, and alloy steel, respectively, they retain assigned responsibilities in connection with the merchandising of these products, assuming broader sales duties in selected districts.

ARTHUR B. WILLIAMS of Engineered Electronics Co., Santa Ana, Calif., has been elected a vice-president of the firm. Mr. Williams has been sales manager of Engineered Electronics Co., a wholly owned subsidiary of Electronic Engineering Co., of Calif., since he joined the organization in October, 1957, and will continue in that capacity.

JACK NEWLOVE has been promoted to district manager of the El Segundo, Calif., office of Vickers Incorporated, a division of Sperry Rand Corporation. Mr. Newlove was formerly an application engineer at the Detroit office. He is a member of the Society of Automotive Engineers and the Engineering Society of Detroit.

ALLOY TUBE DIVISION, the Carpenter Steel Co., Union, N. J., has moved its western regional sales headquarters from San Francisco to 2304 Huntington Drive, San Marino, Los Angeles. HARRY L. HARNER is western regional sales manager.

MACHINERY SALES CO., 1946 E. Bethany Road, Phoenix, Ariz., has been appointed sales representative for the state of Arizona by MICHIGAN TOOL CO., Detroit, Mich., and its Gear-O-Mation Division. JOHN P. REEVES will be in charge of sales and service representation.

Illinois

EARL TAYLOR, tool and methods engineer for Wales-Strippit, Inc., Akron, N. Y., manufacturer of hole-punching and notching equipment, has recently been transferred from the western Michigan and northern Indiana territory to the south Chicago metropolitan area and adjoining counties in Illinois and Indiana. BILL L. GAINES will represent the company in Mr. Taylor's former territory. Both men will operate out of the Midwest Division office located at 408 W. Madison St., Oak Park, Ill.

ROY HEYNE CO., 728 W. Buchanan, Phoenix, Ariz., has been appointed sales representative for SIZE CONTROL CO., a division of American Gage & Machine Co., Chicago, Ill. The Heyne Co. will be their exclusive representative in Arizona and New Mexico. E. E. OLDS, vice-president of Size Control Co., announced the appointment of two representatives to service eastern Canada: FRANK J. COX SALES CO., 6 Elmview Court, Islington, Ontario, and D. M. DUNCAN MACHINE CO., LTD., 1958 Wyandotte St. East, Windsor, Ontario, Canada.

CLEARING, division of U. S. Industries, Inc., Chicago, Ill., announces the appointment of JACK DUSTMAN & ASSOCIATES to be its local dealer in Indiana and Kentucky for open-back inclinable and horning presses up to 200 tons capacity. Included is the new Torc-Pac line, which is now available in 22-, 32-, and 45-ton capacities.

ARTHUR A. CRAFTS CO., INC., has been appointed an authorized limited-line distributor of Carboloy cutting tool products in central Illinois for the Metallurgical Products Department, General Electric Co., Detroit, Mich. The distributor company is located at 10340 W. Berteau Ave., Schiller Park, Ill.

The Chicago branch of the L. S. STARRETT CO., Athol, Mass., now occupies larger quarters in a new sales office and warehouse building at 4949 W. Harrison St., Chicago, Ill. The new Chicago headquarters is under the direction of W. W. HASKINS, western sales manager.

New England

WALLACE S. WHITTAKER has been elected chairman of the executive committee of PRATT & WHITNEY CO., Inc., West Hartford, Conn., the machine tool subsidiary of Penn-Texas Corporation. Mr. Whittaker, a member of the board of Pratt & Whitney, has also been elected chairman of the board of the POTTER & JOHNSTON CO., a Pratt & Whitney subsidiary.

Wallace S. Whittaker, newly elected chairman of the executive committee, Pratt & Whitney Co., Inc.

PRATT & WHITNEY CO., INC., West Hartford, Conn., has named JAMES H. DALEY as sales manager of its Machine Tool Division. He assumes the position held by JAMES D. ALLAN who will remain with the company as a sales consultant until his retirement in July. Mr. Allan's retirement will mark the end of a long distinguished career with the company which dates back to 1923. Mr. Daley, who joined the company in 1941, returns to the home office after serving as district manager of the Cincinnati office. HOWARD B. UPHAM, former Cincinnati district sales manager of cutting tools and gages, has been named to assume Mr. Daley's former duties. ARTHUR LADUCER, formerly on the sales staff of the Milwaukee office, has been

Aluminum or zinc clad steel by production metallizing

- *any shape or size*
- *unlimited thickness*
- *no heat distortion*

Modern metallizing provides the product engineer with an extremely flexible, practical method of producing aluminum or zinc clad steel parts. High speed, automated metal spray equipment applies these coatings to practically unlimited thicknesses on any shape or size part without heat distortion.

a typical example

problem: **provide uniform heat distribution on thin steel shell**

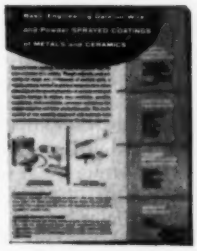
The excellent sanitary qualities of stainless steel make it an extremely desirable material for cooking utensils. But with the comparatively thin, drawn shells (.020″ to .050″—varying by manufacturer), uniform distribution of heat presents a problem.

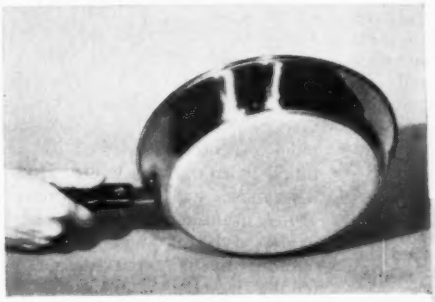
The solution is being provided for a number of high-volume manufacturers by metallized aluminum. Surface preparation is by grit-blasting as the shells rotate on a spindle. Metco Aluminum is then sprayed on the bottom, with automated traverse equipment, to closely controlled thicknesses (from .040″ to .120″, depending on the particular utensil and its manufacturer). The sprayed aluminum is carried up the sides beyond the radius and is tapered off according to individual design.

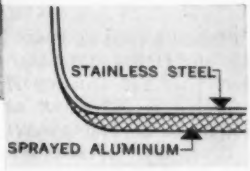
This is but one of many solutions to fabrication problems offered by sprayed metals to design engineers. In addition to the aluminum example given, zinc is also commonly used for corrosion-proofing in many production applications, such as steel capacitor cases, refrigerator parts, pole line hardware, etc. Sprayed zinc is also used to replace coatings burned, threaded, or machined off during fabrication.

For a round-up of some typical applications and engineering data on the characteristics of metallized coatings, write for Bulletin No. 136-A.

FREE BULLETIN ▶







METCO—Reg. U.S. Pat. Off.

Metallizing Engineering Co., Inc.
1131 Prospect Avenue, Westbury, Long Island, N. Y. • cable: METCO
In Great Britain: Telephone: EDgewood 4-1300
METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England

Mr. Donald A. Watson
Metallizing Engineering Co., Inc.
1131 Prospect Avenue, Westbury, Long Island, New York

Please send me ☐ Bulletin 136-A

Name Title

Company

Address City State

For more data, circle this page number on inquiry card

named district sales manager of machine tool sales for the Cincinnati territory.

WILLIAM H. PRESTON has been elected to the position of executive vice-president of CHASE BRASS & COPPER CO., a subsidiary of Kennecott Copper Corporation, Waterbury, Conn. This position has been vacant since GLENN P. BAKKEN was elected president in February 1957. Mr. Preston was formerly associated with the Joy Mfg. Co., Pittsburgh, Pa., where he has held several key executive positions in both general manufacturing and sales.

BLACK ROCK MFG. CO., Bridgeport, Conn., has purchased the entire line of Reed-Prentice lathes and milling machines from PACKAGE MACHINERY CORPORATION, East Long Meadow, Mass. Black Rock has been designing and building special machinery for more than fifty years.

J. W. MENDER CHAIN & GEAR CO. has been appointed as industrial distributor to handle all of Acme Chain Corporation's products on the West Coast. Complete line of Acme roller chains and accessories will be stocked and distributed from Mender's Portland, Ore., branch, as well as their Los Angeles, Calif., warehouse at 6011 S. Central Ave.

VERSON ALLSTEEL PRESS CO., Chicago and Dallas, has announced the appointment of DONALD H. PHIPPS as exclusive distributor of Verson equipment in Massachusetts, Connecticut, and Rhode Island. Mr. Phipps will serve his territory from offices in Needham, Mass.

CARL A. ANDERSON, former vice-president in charge of the MINNEAPOLIS-HONEYWELL REGULATOR CO.'s Aeronautical Divison in Canada, has been named general manager of the company's recently acquired MARION ELECTRICAL INSTRUMENT CO., Manchester, N. H.

FRANKLIN MEYER, JR., formerly in charge of the company's Instrument Gage Division, has been named manager of the Small Tool and Gage Divisions of Taft-Peirce Mfg. Co., Woonsocket, R. I. He succeeds PAUL V. MILLER who retired from active service on December 31, 1958, to become a consulting engineer for the firm. Mr. Miller has been associated with Taft-Peirce since 1920.

New York, New Jersey, and Maryland

AIR REDUCTION SALES CO., a division of Air Reduction Co., Inc., New York City, has announced the completion of a new facility for the production of oxygen and nitrogen at 1100 Packard St., in the Armourdale district of Kansas City, Kans. The new plant replaces an Air Reduction facility in Kansas City, Mo. District offices, storeroom, and engineering services department remain at 2701 Warwick Trafficway, Kansas City, Mo. W. B. MOEN, assistant director of metallurgical research at Air Reduction's research laboratories, Murray Hill, N. J., has been named manager of engineering for the newly formed special products department at Union, N. J.

Share owners of SYLVANIA ELECTRIC PRODUCTS, INC., voted approval of the merger of Sylvania into GENERAL TELEPHONE CORPORATION at a special meeting in Boston, Mass. Concurrently, in New York City, share owners of General Telephone also approved the merger. At this meeting a new corporate name—GENERAL TELEPHONE & ELECTRONICS CORPORATION—was also approved. DONALD C. POWER, president of General Telephone, will become chairman of the board and chief executive officer of the combined corporation, while DON G. MITCHELL will become president, also continuing as chairman of Sylvania. Sylvania will continue to operate as a separate company, wholly owned by the General Telephone & Electronics Corporation.

EDLUND MACHINERY CO., Cortland, N. Y., now offers a new contract manufacturing service for deep-hole drilling operations on production runs, small lots, and experimental work. Edlund has developed a new vertical gun-drilling machine that utilizes the full potential of the modern, rotating carbide gun drill. A battery of these machines are available in the contract service department.

UNION CARBIDE CORPORATION, New York City, has announced the appointment of two division vice-presidents. WILLIAM B. NICHOLSON has been appointed a vice-president of the Linde Co., and ROBERT F. FLOOD, vice-president—gas products. Both Mr. Nicholson and Mr. Flood joined Union Carbide in 1935 as engineers in the development laboratory of Linde Co., Newark, N. J.

HOWARD F. CARVER has been named assistant general manager of GLEASON WORKS, Rochester, N. Y. The post is a new one. Mr. Carver continues as vice-president in charge of sales and a member of the board of directors.

FRANK P. WRIGHT has been appointed sales engineer by Lowey-Hydropress Division of Baldwin-Lima-Hamilton Corporation, New York City. Mr. Wright will represent the company in Alabama, Tennessee, and Georgia.

M. L. MANDEVILLE has been named vice-president and director of sales of the International Division of U. S. Industries, Inc. In his new capacity, Mr. Mandeville will direct export sales of heavy machinery and equipment.

CUTTING TOOL DIVISION, Brown & Sharpe Mfg. Co., Providence, R. I., announces the addition of a new customer service. A complete cutter- and tool-sharpening service, the BROWN & SHARPE CUTTER SERVICE CO. OF NEW JERSEY, at 590 Grand Ave., Ridgefield, N. J., is independently operated and staffed by factory-trained cutting tool specialists.

ROBERT H. VAN HUIZEN has been named sales engineer in the mid-Atlantic territory for ENGELBERG, INC., Syracuse, N. Y., manufacturers of abrasive-belt machinery. Mr. Van Huizen will make his headquarters at 106 Struyk Ave., Paterson, N. J.

PANGBORN CORPORATION, Hagerstown, Md., has elected RALPH M. TRENT president of the corporation. ROBERT H. MCCAULEY was elected

Ralph M. Trent, president of the Pangborn Corporation

director of the corporation by the stockholders. Both appointments fill the unexpired term of VICTOR F. STINE, recently deceased. Mr. Trent has been associated with the Pangborn Corporation for twenty-eight years.

Ohio

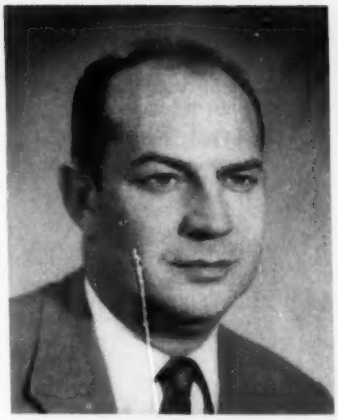
THE NATIONAL MACHINE TOOL BUILDERS' ASSOCIATION announces the appointment of a new chairman and five new members of its Electrical Standards Committee. NELSON P. BASHOR, director of the Electrical Controls Division of W. F. & John Barnes Co., becomes committee chairman. Other new appointees to the NMTBA 1958-1959 Electrical Standards Committee are N. ALBERT ANDERSON, chief electrical engineer, Grinding Machine Division, Norton Co.; REEVE W. DEAN, assistant to the president, Niagara Machine & Tool Works; LELAND S. INSCHO, electrical engineer, Pratt & Whitney Co., Inc.; JACK NORTH, electrical engineer, Micromatic Hone Corporation; and KENNETH F. SMITH, electrical engineer, the Foote-Burt Co.

CINCINNATI MILLING MACHINE Co., Cincinnati, Ohio, has made the following appointments. ALFRED T. BLACKBURN was elected vice-president in charge of manufacturing. Mr. Blackburn has been with the company since 1925 and was named works manager in 1954. CLYDE EBY was appointed works manager. Mr. Eby began his association with Cincinnati Milling in 1936 as a University of Cincinnati Co-op and has served the company in numerous capacities since that time, including manager of manufacturing engineering.

WARNER SEELY, vice-president of the Warner & Swasey Co., Cleveland, Ohio, retired at the close of 1958 after forty-six years of service with the company. He remains a director. Born in Brockport, N. Y., Mr. Seely attended Amherst College and joined Warner & Swasey as a special apprentice in 1912. Following service with the A. E. F. as first lieutenant, he was named assistant secretary in 1919, secretary in 1923, and vice-president in charge of public relations in 1951.

Mr. Seely has served as president of the Cleveland Engineering Society and is also a member of the American Society of Mechanical Engineers, the American Astronomical Society, and Beta Theta Pi. He will continue to maintain his wide interest in many civic and engineering affairs and societies.

Warner Seely, director of the Warner & Swasey Co.



Alfred J. Chandler, vice-president, Brush Division, Osborn Mfg. Co.

ALFRED J. CHANDLER has been appointed vice-president of the Brush Division of the Osborn Mfg. Co., Cleveland, Ohio. Mr. Chandler joined the Osborn organization in 1945 as a sales engineer. He later served as project engineer in Osborn's Technical Department as assistant manager of industrial sales, as manager of industrial sales, and at the time of his appointment was sales manager.

O. M. BUNDY has been named manager of the New Products Division of Clark Controller Co., Cleveland, Ohio, manufacturer of electrical control devices, components, and systems. The new position is in addition to his present duties as director of research.

EDWARD Q. HOLSTON has been named Ohio district supervisor for Vascoloy-Ramet Corporation, Waukegan, Ill. Mr. Holston is establishing headquarters in Bay View, Ohio, at 457 Parkside Drive.

(Left) Alfred T. Blackburn, vice-president, manufacturing, and (right) Clyde Eby, works manager, Cincinnati Milling Machine Co.

Pennsylvania

Purchase of the Kellogg specialty alloy steel manufacturing business from the M. W. KELLOGG CO., subsidiary of PULLMAN INC., by FIRTH STERLING INC., of Pittsburgh, Pa., was announced jointly by officials of the two firms. All patents, inventories and production facilities of the Kellogg ingot process have been acquired. KENNETH D. MANN, president of Firth Sterling, stated that, for the present, operation of the plant in Jersey City, N. J., would continue without interruption to production and shipping schedules. R. K. HOPKINS will have enlarged

responsibilities as a vice-president of Firth Sterling. The process will henceforth be known as the Hopkins Process in recognition of the individual who developed it.

John E. Newlin, Jr., general manager —sales service, Carpenter Steel Co.

CARPENTER STEEL CO., Reading, Pa., announces changes in managerial posts. JOHN E. NEWLIN, JR., formerly manager of tool steel sales for the company, has been appointed to the newly created position of general manager of sales service. Succeeding him is T. ALLEN WASHBURN. Mr. Newlin's duties will be to supervise and develop better customer services from the Reading plant. In this position, Mr. Washburn will be responsible for building and maintaining the sales of Carpenter tool steels.

RIVETT LATHE & GRINDER, INC., Boston, Mass., has appointed STANLEY BERG, INC., 1231 Banksville Road, Pittsburgh 16, Pa., as exclusive distributor in western Pennsylvania for Rivett air and hydraulic valves, cylinders, and power units.

D. F. GRIFFIN was recently appointed chief metallurgist of Landis Machine Co., Waynesboro, Pa. He was formerly with Vanadium-Alloys Steel Co.

Wisconsin, Michigan, and Indiana

ROBERT E. MITCHELL has been appointed plant manager of the Dynamatic Divison, Eaton Mfg. Co., Kenosha, Wis. He is a former member of the company's central industrial relations staff in Cleveland.

W. E. THEW SUPPLY CO., INC., 339 S. Broadway, Green Bay, Wis., has been appointed a distributor of industrial tube and hose fittings for the Parker-Hannifin Corporation of Cleveland, Ohio.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wis., has announced new appointments: HARRY C. SOUKUP is the new general manager and EDWARD F. WOYTYCH is now works manager. Mr. Soukup had been works manager and acting general manager since April, 1958. Woytych had been assistant works manager, having received that appointment May, 1958. FRED BURDETT and ROBERT L. BRANDENBURG have been transferred from their positions as chief sales engineers to the company's field sales division. Mr. Burdett will work in the central United States and Mr. Brandenburg will move to the eastern seaboard.

(Left) Edward F. Woytych, works manager, and (right) Harry C. Soukup, general manager, Giddings & Lewis Machine Tool Co.

JESSE A. EDWARDS has been named Detroit district supervisor for Vascoloy-Ramet Corporation of Waukegan, Ill. He will supervise all Vascoloy-Ramet operations in the Detroit area and will be located in the Detroit branch office at 15551 W. McNichols Road.

FREDERICK J. KELLER has been appointed assistant sales manager for Whitman & Barnes, Plymouth, Mich., manufacturer of drills, reamers, and carbide tools. Mr. Keller was formerly director of sales for American Saw & Tool Co. and its subsidiaries.

NATIONAL ACME CO., Cleveland, Ohio, has announced the appointment of A. C. DENSMORE as manager of the firm's Detroit office at 14235 Puritan Ave. Prior to this appointment, Mr. Densmore was a field engineer with the company.

MICHIGAN DRILL HEAD CO., Warren, Mich., announces a change of name. The new name is MICHIGAN SPECIAL MACHINE CO. No changes have been made in either personnel or basic operating policies.

A. C. HINZ has been appointed supervisor of sales and engineering for southeastern Michigan by Ross Operating Valve Co., Detroit, a manufacturer of pneumatic valves. Mr. Hinz was previously sales and application engineer for Ross.

ORMAL ANNABLE, general superintendent of production at Chevrolet's Cleveland transmission plant, has been named master mechanic at Buick, Flint, Mich., succeeding the late T. R. TIMM.

CARL J. DEMRICK has been named president of Chrysler Corporation's Amplex Division. Amplex, with headquarters at 6501 Harper Ave., Detroit, Mich., is a producer of powdered metal products.

JOSEPH J. HAUSER has been appointed sales manager of Sahlin Engineering Co., Inc., Birmingham, Mich.

PRODUCTO MACHINE CO., Bridgeport, Conn., has appointed TOOLS & SUPPLIES, INC., Indianapolis, Ind., as distributor for central and southern Indiana. The new branch assembly plant carries a complete stock of Producto die set components available for immediate assembly and delivery. RAY METHIER is the manager.

SPRING STRESSES that formerly required premium-priced materials can now be handled by Duraflex,® which costs no more than regular phosphor bronze. Write for literature and samples, today.

LICENSED
PROFESSIONAL ENGINEERS, MEMBERS
AMERICAN SOCIETY FOR TESTING MATERIALS
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Complete engineering and manufacturing services including design and development of special machinery, mechanical products and spring actuated mechanisms. Stress analysis, spring design, metallurgical data, heat treatment, plant layout, engineering reports, selection of materials and equipment. Tools and products.

August 1, 1958

The American Brass Company
414 Meadow Street
Waterbury, Connecticut

Gentlemen,

SUMMARY OF ENGINEERING LABORATORY REPORT No. 8158

SUBJECT: Fatigue Life and Endurance Limit testing of; "DURAFLEX" Superfine-Grain Phosphor Bronze and Commercial Quality Phosphor Bronze, 5% (A) spring quality strip material.

SPRINGS: Flat spring strip was made into the usual type of contact springs used in switches, relays and instruments. These springs were deflected at about 1 cycle per second in a specially built fatigue testing machine and the deflections recorded.

STRESSES: The springs were deflected from the initial free position of zero stress to a final position having a bending stress of 77,000 p.s.i.

This stress, for phosphor bronze strip is unusually high and is higher than stresses ordinarily recommended for Beryllium-Copper or Stainless Steel for such severe service.

RESULTS: Commercial Quality Phosphor Bronze, 5% (A) springs acquired a permanent set quite early and broke at an average number of deflections of 453,374.

"DURAFLEX" springs were still satisfactory, showed no permanent set, no loss of load and no breakage at 4,000,000 deflections.

CONCLUSION: Design stresses for "DURAFLEX" can be at least 50% higher than the stresses for Commercial Quality Phosphor Bronze, 5% (A) as shown in the TOOL ENGINEERS HANDBOOK.

LICENSED PROFESSIONAL ENGINEER HAROLD C. R. CARLSON No. 25571 STATE OF NEW YORK

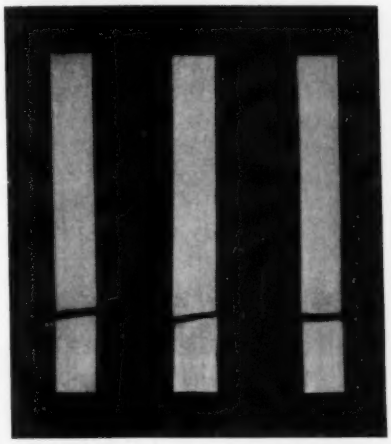
Respectfully submitted,

THE CARLSON COMPANY

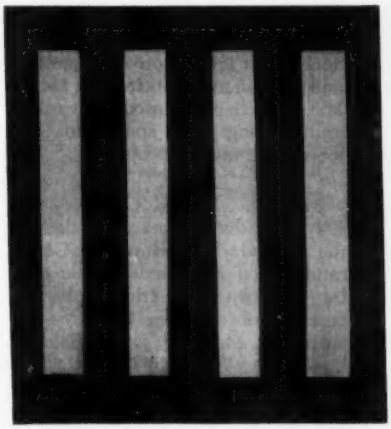
Harold Carlson

Harold C. R. Carlson, P.E.
Licensed Professional Engineer

HC:R



THREE SPRINGS of regular Phosphor Bronze, 5% (A), actual size, took a permanent set at about 200,000 deflections and fractured at an average of 453,374 deflections.



FOUR SPRINGS of Duraflex Superfine-Grain Phosphor Bronze, 5% (A) were still satisfactory after 4,000,000 deflections.

DURAFLEX, available in Phosphor Bronzes (A), (C) and (D), in strip and wire, offers a host of opportunities to cut costs while maintaining or improving quality and performance. For further information and technical help to select the alloy to meet your needs—call in your American Brass Company representative, or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

DURAFLEX
SUPERFINE-GRAIN PHOSPHOR BRONZE
A product of
ANACONDA®
Made by The American Brass Company

For more data, circle this page number on inquiry card

Obituaries

ALBERT J. GIFFORD, treasurer and chairman of the board of Leland-Gifford Co., Worcester, Mass., died in January. He was eighty-two. Mr. Gifford was one of the founders of

Albert J. Gifford

the company, in 1900. He was named treasurer in 1906, and later, chairman of the board of directors. Mr. Gifford was a past-president of the Worcester Engineering Society and a member of the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the American Society for Metals. Many mechanisms used with rolling mills, springs, and special machine tools were invented by him.

MERVYN H. MCCURDY, aged sixty-one, district sales manager of the Baldwin-Lima-Hamilton Corporation, died February 1 while on a business trip in North Carolina. A member of the firm for forty-four years, Mr. McCurdy joined Baldwin Locomotive Works in 1915, working principally in its transportation department. During the 1930's and '40's he was a sales engineer. In 1953, Mr. McCurdy was named sales manager of the organization's southeastern district, encompassing eastern seaboard states from New Jersey to Florida, and westward to Alabama.

AUGUST (GUS) SUNNEN died in his Chatham, Ont., home at the age of sixty-one, on December 23, 1958. He was president and general manager of Sunnen Products Co., Ltd., a Canadian subsidiary of Sunnen Products Co., St. Louis, Mo. He will be remembered for his work in the development and use of automotive service tools.

WAYNE D. DUKETTE, aged sixty-two, died on February 3. He was general manager in Los Angeles for Joseph T. Ryerson & Son, Inc. Previously he occupied similar positions in San Francisco and Cincinnati, after thirty-one years of service at the company's plant in Chicago.

New Books

ESTIMATING MANUAL. 104 pages; illustrated; 8 1/2 by 11 inches. Published by the National Screw Machine Products Association, 2860 E. 130th St., Cleveland 20, Ohio. Price, $7.95.

For the first time in the history of the industry, a comprehensive estimating handbook has been prepared for producers of screw-machine products. It is also available to buyers of these products.

Prepared and published by the National Screw Machine Products Association, the 104-page manual is designed to provide a modern, thorough guide to estimating screw-machine products for both independent producers and company-operated screw-machine departments.

Two years of preparation by a special NSMPA committee is responsible for publication of the handbook. Its purpose is described as "the improvement of estimating practices in all companies of the screw-machine products industry."

Topics covered in the handbook include: basic quoting procedures and qualifications; materials; estimating production on various equipment; setup, operating, administrative, and other costs; specific examples of estimating; and estimating forms and aids.

JIG AND FIXTURE DETAILS AND UNITS. By H. W. Hardy (MACHINERY's Standard Reference Series). 172 pages; illustrated; 5 3/8 by 8 1/2 inches. Published by Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England. Sold in the United States by THE INDUSTRIAL PRESS, 93 Worth St., New York 13, N. Y. Price, $3.

The book is designed for the guidance of the draftsman in the practical design and proportioning of many of the details and units most used in jig and fixture construction. It assumes that the draftsman already possesses general knowledge of the nomenclature, essential features, and details adopted in the design and construction of jigs and fixtures. By studying and applying the various details and units illustrated and tabulated, the reader should acquire sufficient practical knowledge to enable him to make alterations in the details and units shown that would meet any special conditions confronting him. Also, with growing experience, he should be able to develop his own ideas, and not work rigidly to the tabulated designs in the book.

Included in the book are chapters on clamping devices; steady clamps and supports, and steady and indicating pins; clamping devices for circular components; fixed and adjustable vee locators and clamps; combined centralizing and clamping devices; adjustable and compensating support pins, spring-loaded latches, and other devices for leaf jigs; indexing devices and slip washers; and standard pad bolts, clamp nuts, slip and liner bushings, screwed clamping bushings, and control screws.

Coming Events

MARCH 11-13—Tenth Anniversary Spring Technical Meeting to be held at the Pick-Congress Hotel, Chicago, Ill. For further information write Pressed Metal Institute, 3673 Lee Road, Cleveland 20, Ohio.

MARCH 16-20—Western Metal Show to be held at Pan-Pacific Auditorium, Los Angeles, Calif. Contact American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

MARCH 19-20—National Production Meeting, Society of Automotive Engineers, to be held at the Sheraton-Cadillac, Detroit, Mich. Contact Robert W. Crory, Public Relations Manager, SAE, 485 Lexington Ave., New York 17, N. Y.

APRIL 18-22—ASTE Annual Meeting to be held at the Schroeder Hotel, Milwaukee, Wis. Contact American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.; Harry E. Conrad, executive secretary.

MAY 4-8—National Industrial Production Show of Canada at Exhibition Park, Toronto, Canada, under management of E. M. Wilcox, 19 Melinda St., Toronto, Canada.

A-B Reliable Control Units

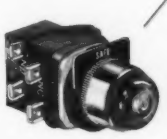
for every industrial application

Among the many hundreds of Allen-Bradley push button and control units, you are certain to find the types best suited to your particular needs. The seven units shown below are a few of the latest additions to the Allen-Bradley *quality* line of control units.

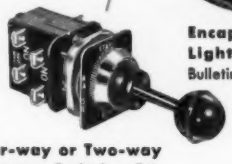
All Allen-Bradley control units—standard duty, heavy duty, and oiltight—have double break, silver alloy contacts—to assure reliable operation. Simple constructions and generous wiring room are outstanding features. Insist on Allen-Bradley control units for *all* of your equipment—you can't go wrong!

NEW

Illuminated Push Button. Combines pilot light and push button in one unit. Oiltight Bulletin 800T.



Push-to-Test Pilot Light. Oiltight Bulletin 800T.



Four-way or Two-way Selector Switch. Oiltight Bulletin 800T.

Encapsulated Pilot Light. Heavy Duty Bulletin 800.

Encapsulated Pilot Light. Oiltight Bulletin 800T.

Time Delay Push Button. Delay is adjustable from 0.5 second to 5 seconds. Oiltight Bulletin 800T.

Double Circuit Push Button. Has 2 N.O. or 2 N.C. contacts. Oiltight Bulletin 800T.

ALLEN-BRADLEY OFFERS the most complete line of standard duty, heavy duty, and oiltight control stations on the market. Send for Publication 6090 today.

4-59-MR

ALLEN-BRADLEY
MOTOR CONTROL
QUALITY

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Positive Protection Against Phase Failure and Phase Reversal ?

Here is your answer!

The Allen-Bradley Bulletin 812 Type F, Type R, and Type RF relays provide positive protection against the hazards to men, motors, and driven machinery, resulting from phase failure and/or phase reversals.

The Bulletin 812 Style F phase failure relay employs a unique static sensing network that responds to all open phase conditions on a motor branch circuit and immediately removes the motor from the line . . . irrespective of the load on the motor (including no load), or the circuit arrangement. This relay even responds to hard-to-detect primary failures on a wye-delta transformer with ungrounded neutral. Furthermore, the five-cycle response prevents nuisance "drop-outs" from transient fluctuations.

The Bulletin 812 Style R phase reversal relay disconnects the motor from the line—whether it is running or not—when a phase reversal occurs anywhere in the system on the line side of the relay. Thus, it can be employed for a single motor, a group of motors, or an entire power system. In addition, the phase reversal relay prevents the motor from starting should phase failure occur while at a standstill—a vital feature for elevator applications.

The Bulletin 812 Style RF relay combines the elements of Style R and Style F relays for protection against both phase failure and phase reversal. All Bulletin 812 relays are inherently "fail safe." Send for complete information.

Allen-Bradley Co., 1316 S. Second St.
Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd.
Galt, Ont.

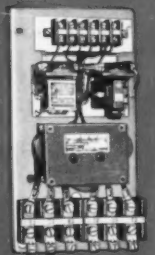
ALLEN-BRADLEY
QUALITY
MOTOR CONTROL

4-59-MR

Bulletin 812, Style RF for Phase Failure and Phase Reversal

INDIVIDUAL RELAY UNITS AVAILABLE

For Phase Failure



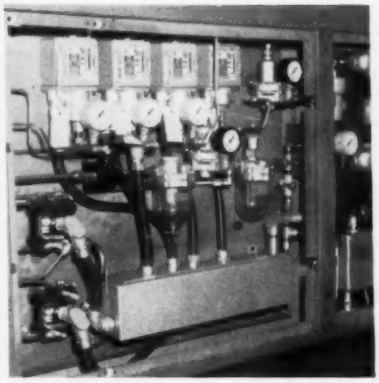
Style F covers full load currents from 1.5 to 300 amp in 4 sizes. Coils for up to 600 v, 60 cycles.

For Phase Reversal

Style R made with coils for 110, 208/220, 440, 550 v for either 50 or 60 cycle operation.

Skinner solenoid valves solve many different cylinder control problems

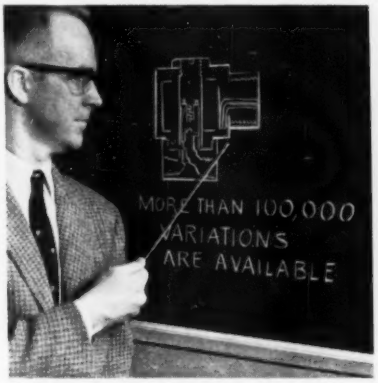
Application. This Bryant "Centalign" automatic internal grinder is an entirely new concept in precison grinding machinery. Work parts are gravity-fed through chutes and loaded to grind position automatically. Centalign design permits higher, more accurate production at lower cost in the grinding of straight or tapered bores or forms such as ball tracks.



Seven Skinner valves used. Four-way, V9 valves control cylinders actuating work ejector, work interceptor and work loading chute. Others control cylinders for activating a diamond holder for wheel sizing; an oscillator for grinding; and a compensating cylinder to skip wheel dressing action. Still another controls the shop-air supply to the machine.

Adjustable flow features of the four-way valves permit split-second adjustment of cylinder action. And all the valves are small, compact and easy to mount at any angle. Built-in spring returns assure positive closing. Such features enable Bryant to manufacture the Centalign in panels that afford easy access to all pneumatic, hydraulic and electric circuits.

A complete line. There's a Skinner solenoid valve for almost any flow application with a wide variety of media: air, oil, water, inert gases, hydraulic fluids, kerosene and gasoline. Orifice sizes range from $\frac{3}{64}$" to 1". Pressure ratings range from 5 psi to 3000 psi. Explosion-proof models are UL approved for Class 1, Group D and Class 2, Groups F and G.



100,000 variations. The Skinner valves used by Bryant are so versatile in design that standard models can be used for applications normally calling for specials. Skinner solenoid valves are engineered to have a life expectancy of millions of trouble-free cycles.

Quality assured. Electrical tests to UL Standards include resistance check of coils in valve; breakdown check of 2x's rated voltage plus 1,000 volts; heat rise check of continuously energized coil for operation not above 85°C (185°F) rise above room temperature. These tests assure that you can use Skinner solenoid valves with confidence.

Skinner solenoid valves are distributed nationally.

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 553.

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

THE SKINNER ELECTRIC VALVE DIVISION • NEW BRITAIN, CONNECTICUT

use Airco's new Dip Transfer CO_2 Process

for **ALL-POSITION WELDING OF**

In welding mild sheet steel manually, there's only *one way to reduce costs and produce high quality welds* at the same time. Airco Dip Transfer CO_2 Process Welding. Let's be specific: –

- The complete Airco Dip Transfer CO_2 package welds in all positions . . . manually!
- Welds are hydrogen-free.
- Virtually ends warpage – only low average currents are used for burn off.
- Creates little or no spatter.
- Handles typical steel joint fit ups.
- No flux needed.
- Penetrates deeply – critical for high quality.
- Welds much faster than flux-based processes.
- Uses money-saving Pureco CO_2 as shielding gas.
- The basic equipment welds all weldable metals.

The Airco Dip Transfer CO_2 Process gives you consistently *high quality* welds at *lower costs* than any other process. For complete information, phone or write your nearest Air Reduction Representative. Ask for the new 24-page "DIP TRANSFER" Catalog.

Here's what you need: —

● Aircomatic® Pull Gun AH35A, with portable carriage assembly for wire reel and controls. Provides the **constant** wire speed necessary.

● Aircomatic Fillerarc Motor Generator Power Source, with rising volt-amp characteristic. Holds constant arc length regardless of current changes. Built-in reactance achieves filler wire turn-off at low average currents and at very low spatter levels.

● Aircomatic Steel Wire A675. Consumable. No flux to slow welding speed or reduce arc visibility. Well-suited for mild steel and alloys such as manten and corten. Diameter of .035" actually permits cost savings on welding steels from 16 ga. to ¾".

● Pureco CO_2* Welding Grade Gas. Plus associated Airco Regulator, Hoses, Cables, flexible wire casing.

STEEL IN ALL THICKNESSES

low costs • easy fit up •
high speed •
very low spatter • no warpage

VISIT OUR BOOTH 571 APRIL 7-10, '59
INTERNATIONAL AMPHITHEATRE, Chicago, Ill.
WELDING SHOW
Sponsor: AMERICAN WELDING SOCIETY, INC.
APRIL- NATIONAL WELDED PRODUCTS MONTH

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*Pureco CO_2 is supplied by the Pure Carbonic Company, a division of Air Reduction Company, Incorporated.

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AIR REDUCTION SALES COMPANY
A division of Air Reduction Company, Incorporated
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On the west coast—
Air Reduction Pacific Company
Internationally—
Airco Company International
In Cuba—
Cuban Air Products Corporation
In Canada—
Air Reduction Canada Limited
All divisions or subsidiaries of Air Reduction Company, Inc.

For more data, circle this page number on inquiry card

Product Directory

To find headings easily, look for capital letters at top of each page to denote location.

ABRASIVE CLOTH, Paper and Belt
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ABRASIVES, Disc
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.

ABRASIVES, Polishing, Tumbling, Etc.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Macklin Co., Jackson, Mich.
Norton Co., 1 Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

ACCUMULATORS, Hydraulic
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

"WHEN LATHES JAM...

look out!"

"Production engineers who specify or influence the purchase of metalworking lathes for industry know that jamming of a lathe carriage or tool can cause costly gear breakage and flying metal. But it does happen.

"What I didn't know was that only one company—Logan Engineering—makes 12" screw cutting and turret lathes that include a *built-in* automatic safety gear as standard equipment. At the instant of overload, the safety gear disengages, guarding against damage in the train of gears from spindle through gear box.

"We not only save maintenance by using this fine Logan 12" lathe with its 38 to 1400 rpm variable speed drive and no *manual belt shifting*. We get 'built-in' insurance against heavy repairs and production slow-downs—for a lower price!"

NOTE: The above features are standard equipment, too, on Logan 14" screw cutting models (variable speed range, 38 to 1400 rpm). On all Logan 11", 10" and 9" lathes, automatic safety gear is optional.

LOOK AT A LOGAN BEFORE YOU LEAP

LOGAN AUTOMATIC SAFETY GEAR ⟶

Logan 12" Swing Lathe

The Logan line includes lathes from 9" swing and 17" between centers to 14" swing and 40" between centers. Also 8" shapers.

CATALOG ON REQUEST. Phone your LOGAN dealer or drop a line to—

LOGAN ENGINEERING CO.
Dept. K-359, 4901 Lawrence Avenue, Chicago 30, Illinois

Logan

AIR GAGES, Dimensional—See Gages Air Comparator

AIR GUNS
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

AIR TOOLS—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOYS, Bearing
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Mueller Brass Co., Port Huron, Mich.

ALLOYS, Non-ferrous—See Brass, Copper, Zinc and Stellite

ALUMINUM and Aluminum Products
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

ANGLE PLATES—See Set-Up Equipment

ANNEALING FURNACES
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

ARBOR PRESSES—See Presses Arbor

ARBORS AND MANDRELS
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

Take a Critical Look

at the design of your Gear Shaving Machines

In today's competitive economy, it is imperative to scrutinize each production machine from the standpoint of operating costs. Just what does it contribute? What does it cost to operate? How does its design affect its operating economy? These questions suggest other more specific questions in the case of gear shaving machines:

CHIPS

- Are the cutters of your machines so located that chips fall away from them rather than into them?

LOADING HAZARD

- If, while loading, a work gear accidentally slips from the operator's fingers will it fall into the cutter teeth?

GRAVITY

- Is cutting pressure applied downward, taking advantage of gravity or upward, unpredictably taking up the operating clearance of the table ways?

AUTOMATION

- Are the extra components needed to automate the machine, in the way when the cutter is changed?

RIGIDITY

- Does the single solid cast column provide more rigidity than one made up of bolted sections?
- Is a deep massive table assembly held in position by gravity more rigid than a shallower, lighter assembly hung from above?

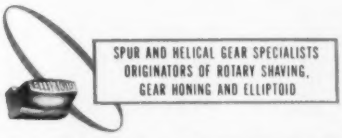
OBSTACLES

- Are there any projections above table level to interfere with the operator's movements as he loads a work piece or changes the cutter?

FEED

- Is the automatic feed mechanically positive and consistently precise?

To check your answers to these pertinent questions, call your Red Ring representative and suggest he bring along Bulletins AP 57-11 and S-57-2—All in the interest of ECONOMY.

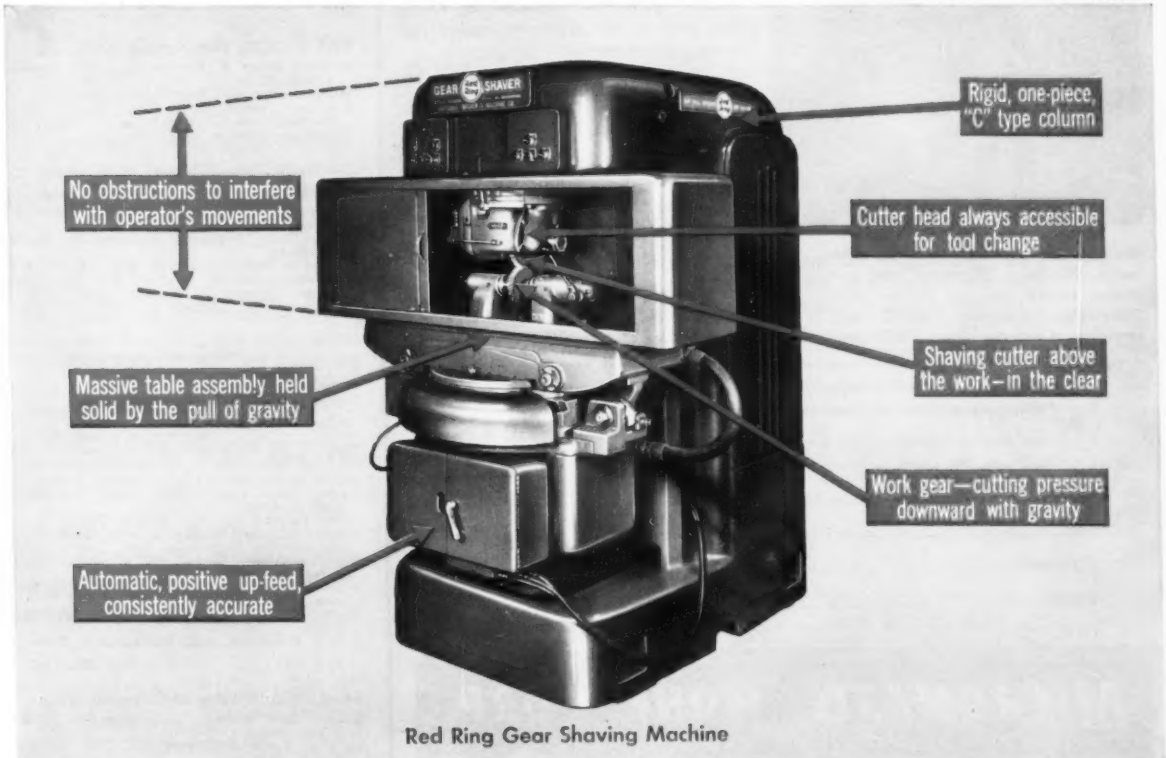


NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

8159

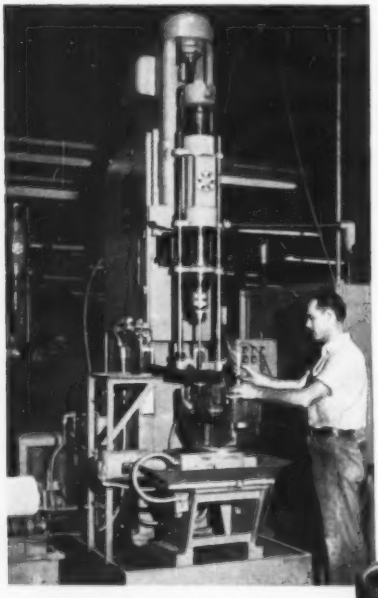

No obstructions to interfere with operator's movements
Massive table assembly held solid by the pull of gravity
Automatic, positive up-feed, consistently accurate
Rigid, one-piece, "C" type column
Cutter head always accessible for tool change
Shaving cutter above the work—in the clear
Work gear—cutting pressure downward with gravity

Red Ring Gear Shaving Machine

For more data, circle this page number on inquiry card

WHY Emerson Electric MICROHONES Laminated Steel Rotors

The Emerson Electric Manufacturing Company is constantly searching for the best possible processing methods. Working with Micromatic engineers on problems encountered in processing shaft holes in their laminated steel rotors, Emerson Electric found that Microhoning would provide much higher production quality while lowering processing costs. The following Microhoning benefits are now obtained:



Model 728 Hydrohoner with automatic Microsize, Microdial and two station rotary indexing fixture. Hole Tolerances: Diameter .0002 inch, straightness and roundness .0001 inch.

CUT REJECTS
With former processing method rejects ran too high. Microhoning controls size and assures a clean hole—rejects are substantially reduced.

ELIMINATED OPERATIONS
Old processing method required two operations. In one operation, Microhoning generates size and straightness within specified tolerances.

REDUCED BALANCING TIME 70%
To preclude vibration and poor operating characteristics, it is essential that shaft hole be concentric with O.D. of rotor. Microhoning reduced by 70% the amount of dynamic balancing correction required.

PROCESSING COSTS CUT 70%
Current figures show the cost of Microhoning shaft holes in rotors to be less than 30% of processing by old method.

Rotors (from 2¼ to 4 inches long) are all Microhoned on the same machine by changing adaptor in fixture and resetting stroke length.

Learn why Microhoning will give you efficient stock removal, closer tolerances, accurate alignment and functional surfaces.

☐ Please have a Micromatic Field Engineer call.
☐ Please send Micromatic literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE ____ STATE ____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

ARC WELDERS—See Welding Equipment, Arc

ASSEMBLING MACHINES
Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

AUTOMATIC SCREW MACHINES—See Screw Machines, Single and Multiple-Spindle Automatic

BABBITT
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BACTERICIDES
Lilly, Eli and Co., Indianapolis 6, Ind.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.

BALANCING EQUIPMENT
Balance Eng. Co., 5024 W. Lake St., Chicago 44, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

BALLS
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Kennametal, Inc., Latrobe, Penna.

BAR MACHINES—See Screw Machines, Single and Multiple-Spindle, Automatic

BAR STOCK, Non-ferrous
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Shenango Furnace Co., Dover, Ohio

BAR STOCK AND SHAFTING, Steel
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARING PILLOW BLOCKS AND CARTRIDGES
Fafnir Bearing Co., New Britain, Conn.

BEARINGS, Ball
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

BEARINGS, Bronze and Special Alloy
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio

BEARINGS, Oilless
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

BEARINGS, Roller
Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio

BEARINGS, Thrust
Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio

BELTING, Transmission
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

BELT SANDERS—See Grinding Machines, Abrasive Belt

BENCH CENTERS
Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BENDERS, Bar, Tube, Channel, etc.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDERS, Plate, Etc.
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING MACHINES, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Hydraulic Press Mfg. Co., Mount Gilead Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

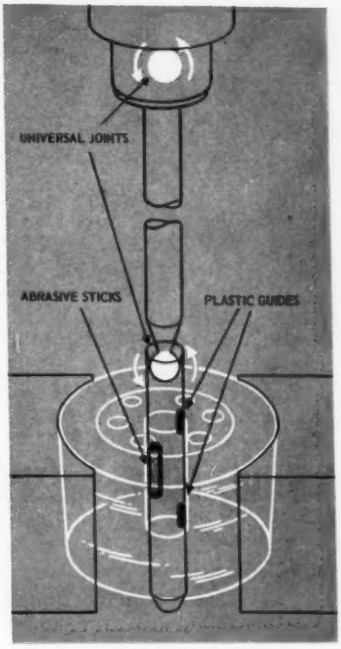
BENDING MACHINES, Pipe
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

BENDING ROLLS
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

HOW MICROHONING Laminated Rotors Cuts Processing Costs

Emerson Electric squirrel-cage rotors are made of special "electrical grade" steel laminations and each lamination is coated with oxide insulation. In processing the rotor, the O.D. is turned concentric with the shaft hole. Then, in one operation, Microhoning accurately generates finished size and straightness of shaft hole without any change in hole location.

The Micromold tool has two universal joints in the drive shaft which allow the tool body to align itself with the shaft hole. Microhoning of holes is along same axis from which O.D. was turned.



For electrical and mechanical efficiency, assembled motors must have a uniform air-gap between rotor and stator of .006 inch to .011 inch. Because laminated surface is rough and close tolerances must be held, special guided Micromold tools are used. Plastic guides above and below abrasive sticks, control dressing of abrasive and assure generation of round, straight shaft holes.

Before installing Microhoning equipment, two operations were required to finish shaft hole—rejects ran high. Microhoning greatly reduced the amount of dynamic balancing correction required.

The principles and applications of Microhoning are explained in a 30-minute, 16 mm, sound movie, "Progress in Precision" . . . available at your request.

☐ Please send me "Progress in Precision" in time for showing on _____ (date).
☐ Please have a Micromatic Field Engineer call.
☐ Please send Microhoning literature and case histories.

NAME _____
TITLE _____
COMPANY _____
STREET _____
CITY _____ ZONE _____ STATE _____ D

MICROMATIC HONE CORP.
8100 SCHOOLCRAFT AVENUE · DETROIT 38, MICHIGAN

For more data, circle this page number on inquiry card

Your parts last longer when they're

SHENANGO CENTRIFUGAL CASTINGS

Your machine parts, ferrous or non-ferrous, are subject to stress, strain and friction, day after day, year after year . . . so specify Shenango . . . and see what a difference this makes!

Shenango's centrifugal casting process insures longer life because of finer, more uniform, *pressure-dense* grain to begin with . . . free of inclusions, porosity, blowholes and other weakening defects. Then, far less machining is needed and your part is stronger . . . to last and last *and last!*

Shenango's modern and fully-equipped shops will supply you with ferrous or non-ferrous symmetrical parts in virtually any shape or size . . . rough, semi-machined or precision-finished to your most exacting specifications. For full details, write: *Centrifugally Cast Products Division,* The Shenango Furnace Company, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE METAL • ALLOY IRONS

BLAST CLEANING EQUIPMENT
Pangborn Corp., Hagerstown, Md.

BLOWERS
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

BLUING LAYOUT
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

BOLT and NUT MACHINES
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

BOLTS, NUTS AND SCREWS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.
Orban Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BOOKS, Technical
Industrial Press, 93 Worth St., New York 13, N. Y.

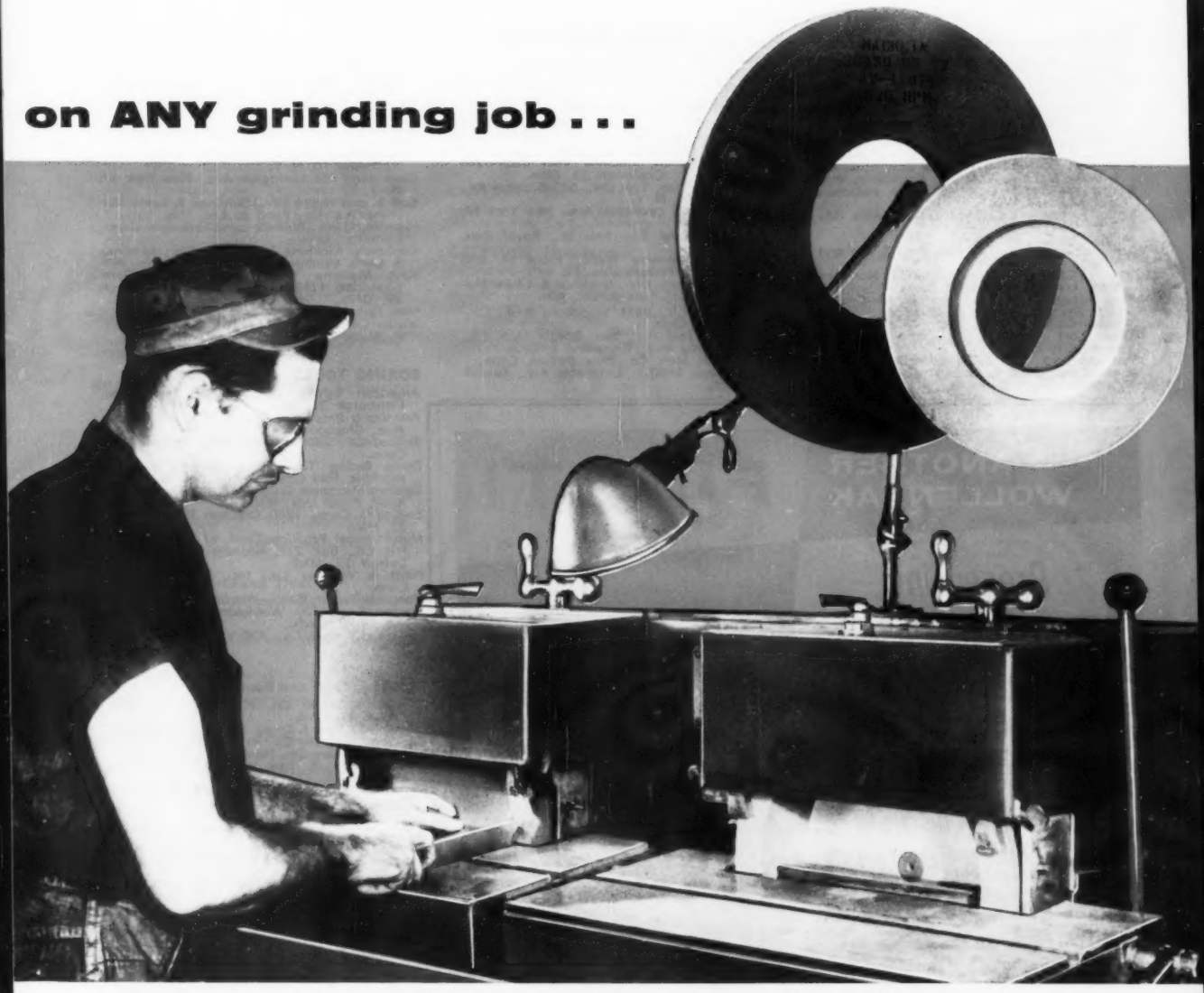
BORING BARS
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 327, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BORING HEADS
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

BORING MACHINES
Baker Bros. Inc., 1000 Post Ave., Toledo 10, Ohio
Bullard Co., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro. Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

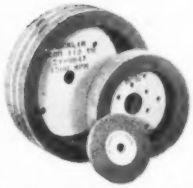
(Continued on page 222)

on ANY grinding job . . .



you can protect your production

with MACKLIN *"Wheels of Profit"*



CUSTOM-ENGINEERED FOR YOUR PARTICULAR GRINDING JOB.

Macklin "wheels of profit" for industry, add value to your work . . . increase your production . . . and turn out a better product. There are Macklin wheels of every type and size for your particular grinding job.

FOR PRACTICAL ANSWERS to your specific grinding problem, consult a Macklin Abrasive Engineer or your local Macklin Distributor. You'll get expert, on-the-job assistance in determining the exact wheel for top production efficiency.

WRITE OR PHONE TODAY FOR COMPLETE INFORMATION

GRINDING WHEELS

MACKLIN company

Dept. 14, Jackson, Mich.

Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Wales-Strippit, Inc., Akron, N. Y.

BORING MILLS, Horizontal

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.

BORING MILLS, Vertical

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Berthiez, Charles, 5 Rue Montalivet, Paris, France
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit, 7, Mich.

BORING TOOLS

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

BRAKES, Press and Bending

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

BRASS

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

BROACHES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

BROACHING MACHINE, Internal

Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

BROACHING MACHINE, Surface

Cincinnati Milling & Grinding Mchs., Inc., Cincinnati, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

BRONZE

American Brass Co., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

BULLDOZERS, Metalforming
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.

BURNISHING MACHINES
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

BURRING MACHINES—See Deburring Machines

BURRS—See Files and Burrs, Rotary

BUSHINGS, Drill Jig
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Corbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Hardened Steel
Universal Engrg. Co., Frankenmuth, Mich.

BUSHINGS, Non-ferrous and Powdered Metal
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.—See Layout and Drafting Tools, Machinists' Small Tools

CALIPER, Vernier
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

CAM CUTTING MACHINES
Cincinnati Milling & Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

CAMERAS, High Speed
Wollensak Optical Co., Rochester 21, N. Y.

CAM MILLING AND GRINDING MACHINES
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

CAMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

CARBIDES
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngtown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

CASTINGS, Die
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Non-ferrous
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Pittsburgh Brass Mfg. Co., 3199 Penn Ave., Pittsburgh 1, Penna.
Shenango Furnace Co., Dover, Ohio
Vascoloy-Ramet Corp., Waukegan, Ill.

CASTINGS—Gray Iron, Malleable
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 1800 Union Commerce Bldg., Cleveland 14, Ohio
Shenango Furnace Co., Dover, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CASTINGS, Steel, Stainless, etc.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

CENTER PUNCHES—See Machinists' Small Tools

CENTERS, Grinding Machines, Indexing Head and Lathe
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CERAMIC TOOL MATERIAL—See Tool Material, Ceramic

CHAINS, Power Transmission and Conveyor
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

CHUCKING MACHINES, Multiple-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKING MACHINES, Single-Spindle Automatic
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

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CHUCKS, Air Operated
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Collet
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio.
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Combination Universal-Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Compensating
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Diaphragm
Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill, Key Type
Jacobs Mfg. Co., West Hartford, Conn.

CHUCKS, Drill, Keyless
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
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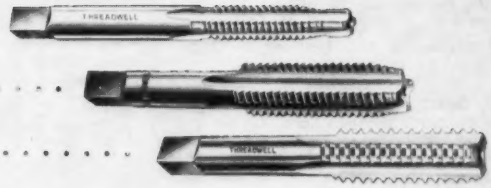

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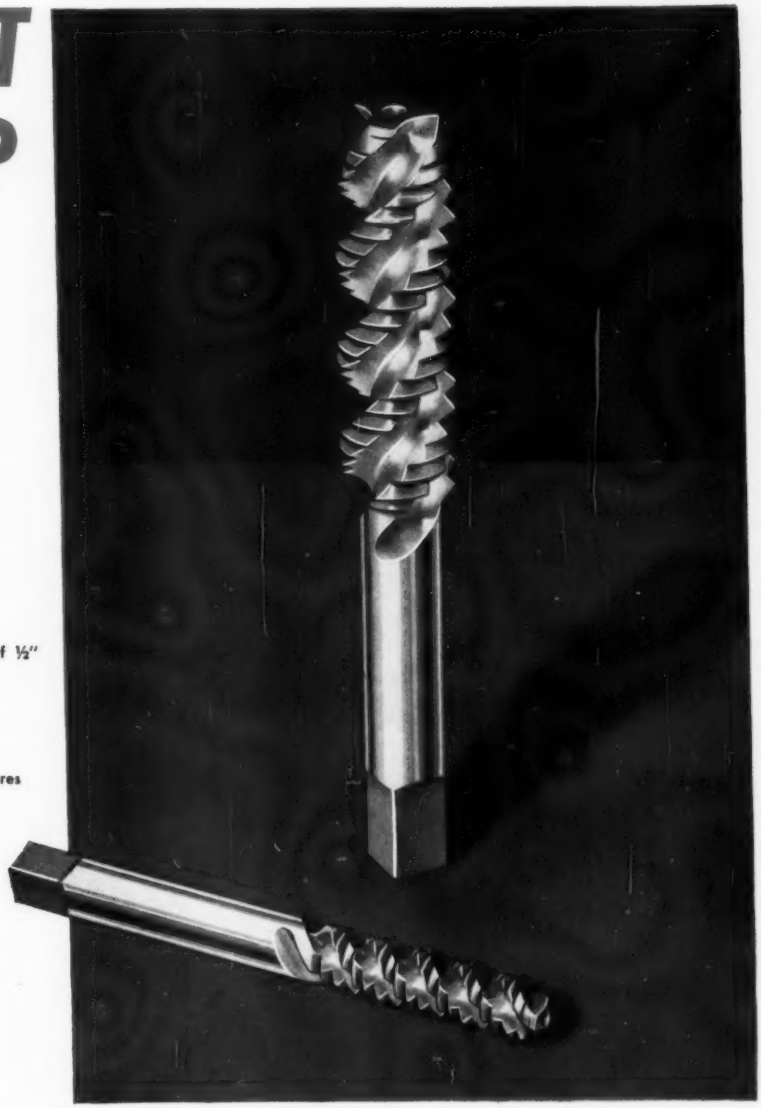

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Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Horton Chuck Co., Windsor Locks, Conn.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Supreme Products, Inc., 2222 S. Calumet Ave., Chicago 16, Ill.

CHUCKS, Independent
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Lathes, etc.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

CHUCKS, Power Operated
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

CHUCKS, Quick Change and Safety
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

CHUCKS, Universal Three-Jaw
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
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Horton Chuck Co., Windsor Locks, Conn.
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Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Wrenchless
Gisholt Mch. Co., Madison 10, Wis.

CLAMPS, "C", Toggle, Toolmakers' Parallel—See Set-Up Equipment

CLEANERS, Metal
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.

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Minster Mch. Co., Minster, Ohio.

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Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

COLLETS—See Chucks, Collet

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Starrett, L. S., Co., Athol, Mass.

COMPARATORS, Optical
Bausch & Lomb Optical Co., Rochester, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
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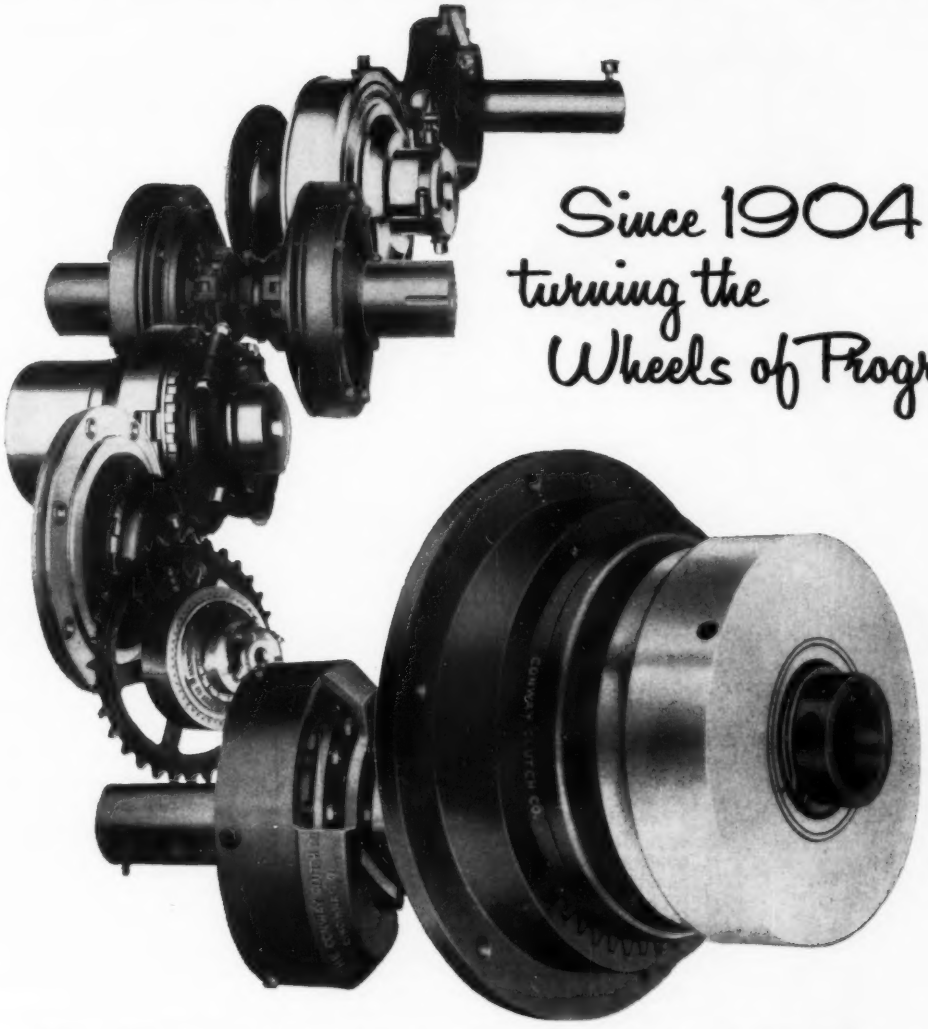

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COMPOUNDS, Cleanings—See Cleaners, Metal

COMPOUNDS, Cuttings, Grinding, Metal Drawing, etc.—See Cutting and Grinding Fluids

COMPRESSORS, Air
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

CONTOUR FOLLOWER—See Tracing Attachments

CONTRACT WORK
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Textile Machine Works, Reading, Penna.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

CONTROLLERS
Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

CONVEYORS FOR DUST, CHIPS, ETC.
Barnes, W. F. & John Co., Rockford, Ill.

COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave. New York, N. Y.

COUNTERBORES AND COUNTERSINKS
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

COUNTERS
Starrett, The L. S., Co., Athol, Mass.

COUPLINGS
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

CRANES, Electric Traveling
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

CUTTERS, Keyseating
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoALL Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.

WHY BUY METAL YOU DON'T USE?

Switch to Allegheny Ludlum Cast-to-Shape Tools

FORGED DISC

Forged disc necessary for fabricating welded tube mill roll.

CAST-TO-SHAPE TOOL STEEL

Cast-to-shape welded tube mill roll. 220 lbs. lighter than forging; $780 cheaper for finished shape.

$780 Saved by changing to Cast-to-Shape

Why pay for metal that ends up chips on your floor? Here are two pertinent reasons why you should stop hogging your complex tools from blocks of metal and let Allegheny Ludlum cast them to shape.

CAST-TO-SHAPE MEANS YOU BUY FEWER POUNDS OF METAL.
For example, the roll shown above is 220 pounds *lighter* in the rough state than its forging cousin. Allegheny Ludlum cast-to-shape tools are more economical than tool steel forgings, *and* just as strong in certain applications.

CAST-TO-SHAPE MEANS LESS FINISH MACHINING.
This is especially important with a complex shape. For instance, the casting above has only ¼ to ⅜ inches of machine stock on its surfaces, requiring only one roughing and one finishing operation. Estimated savings by using an Allegheny Ludlum cast-to-shape tool amount to $780.

WSW 7271

Allegheny Ludlum, a tool steel producer who makes cast-to-shape tools, casts them with the same precise quality control for which their tool steels is known. A full line of cast-to-shape tool steel grades is available. You'll find ones with high resistance to abrasion, compressive strengths of approximately 400,000 psi, easy machinability, hardening with almost no distortion, toughness, high red hardness, and the capacity to take a high polish.

Find out now how you can cut costs on your complex tools. Write for FC-4, a 28-page technical discussion of A-L's Forging and Casting Division with applications, pattern information, design tips, analyses, and heat treating instructions. Or call your nearest A-L tool steel warehouse or distributor.

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Tool Steel warehouse stocks throughout the country . . . Check the yellow pages

EVERY GRADE OF TOOL STEEL . . . EVERY HELP IN USING IT

For more data, circle this page number on inquiry card

CUTTERS, Milling

Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd. Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

CUTTING AND GRINDING FLUIDS

Cincinnati Milling Products Div., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoALL Co., Des Plaines, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Texas Co., 135 E. 42nd St., New York, N. Y.

CUTTING-OFF MACHINES, Lathe Type

Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Modern Machine Tool Co., Jackson, Mich.

CUTTING-OFF SAWS, Abrasive Wheel

DoALL Co., Des Plaines, Ill.
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

CUTTING TOOLS—See Tool Material

CYLINDERS, Air

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

DEBURRING MACHINES

Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.

DIE CASTINGS—See Casting, Die

DIE CASTING MACHINES

Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

DIE CUSHIONS

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Federal Machine & Welder Co., Overland Ave. Warren, Ohio.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

DIE SETS AND DIEMAKERS' SUPPLIES

Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Lempco Industrial, Inc., Bedford, Ohio
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit, Inc., Akron, N. Y.

DIE SINKING MACHINES—See Milling Machines, Die Sinking, etc.

DIE STOCKS—See Stocks and Dies

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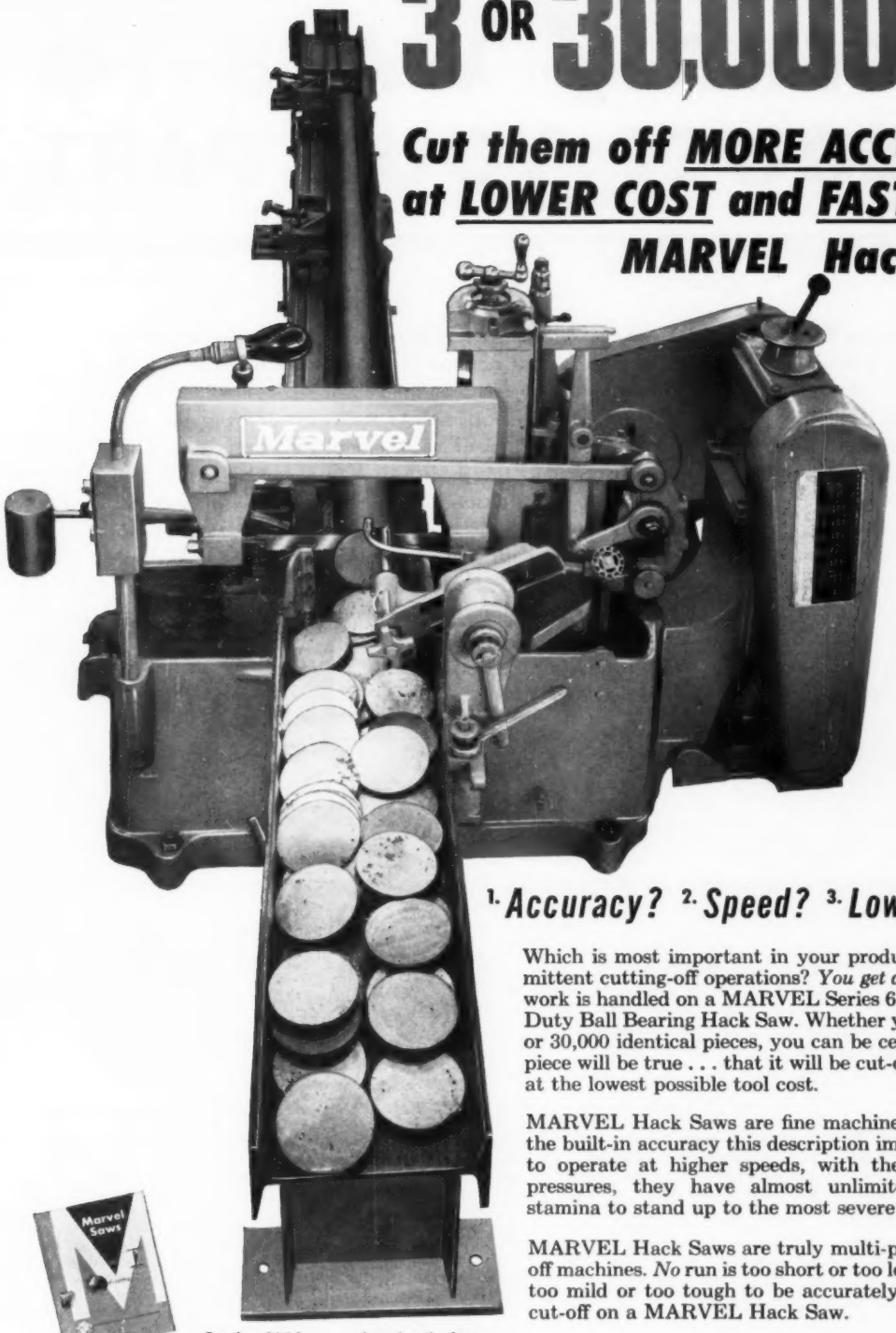

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Send today for free technical literature on any one or all of the seven fabricating methods.

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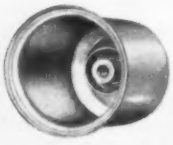
Production equipment is available to produce press, hammer or cored forgings of any practical shape in sizes ranging from a few ounces to 150 lbs. in brass, bronze, aluminum and magnesium in 27 standard, as well as special, alloys.



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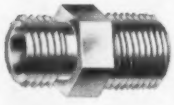
Mueller Brass Co. has complete machinery for producing Cold-Prest impact extrusions of aluminum, copper, brass, bronze and steel. Extrusions up to 28" in length are possible, depending on wall thickness and other design details. Parts can be designed having ribs, flutes, splines or bosses . . . with multiple wall diameters and with uniform or tapered wall sections.



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Mueller Brass Co. has one of the world's largest automatic screw machine departments fabricating both ferrous and non-ferrous custom parts. We can produce an infinite variety of shapes and sizes from ⅛" to 3¼" in wide range of free cutting and specialized alloys. Complete facilities for all secondary and finishing operations, as well.

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Mueller Brass Co. can supply precision Sinteel® powder metal parts in wide range of sizes and metals at high production rate. Parts available from iran, brass and copper alloys. Parts may be ordered with such characteristics as self-lubrication, controlled porosity and good electrical and magnetic properties.

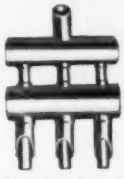
MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

MUELLER BRASS CO.

...and our methods analysis service helps you determine which is the best ...and most economical method

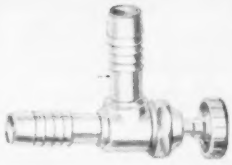
SAND CASTINGS

We specialize in the production of pressure-tight red brass castings. We utilize both metal match plate and wood patterns. Facilities include tool room and pattern shop, electric melting furnaces, high capacity core room and both bench and floor molding equipment to handle wide range of sizes.



FORMED COPPER TUBE

Mueller Brass Co. has modern facilities for forming seamless copper tube into a multitude of shapes. Forming methods used include bending, spinning, expanding or swedging, upsetting, flaring, flattening, beading and grooving, drilling and piercing, machining and joining. Formed copper tube coils are also available as single, double, spiral and serpentine shapes.



PLASTIC INJECTION MOLDING

Injection molding of plastic parts is still another process offered by the Mueller Brass Co. Parts are molded from such plastics as—nylon, polyethylenes, polyvinyl chloride, styrenes, linear acetal, chlorinated polyether, polycarbonates or polypropylene, dependent on part application.

MAN FROM MUELLER BRASS CO.

Since only Mueller Brass Co. can produce your part by all the methods, only the Man From Mueller Brass Co. can give sound advice on the one best method of production. Over 40 years of research, engineering, manufacturing and marketing experience stands behind him. When you are specifying and purchasing fabricated metal parts, call in the MAN FROM MUELLER BRASS CO.

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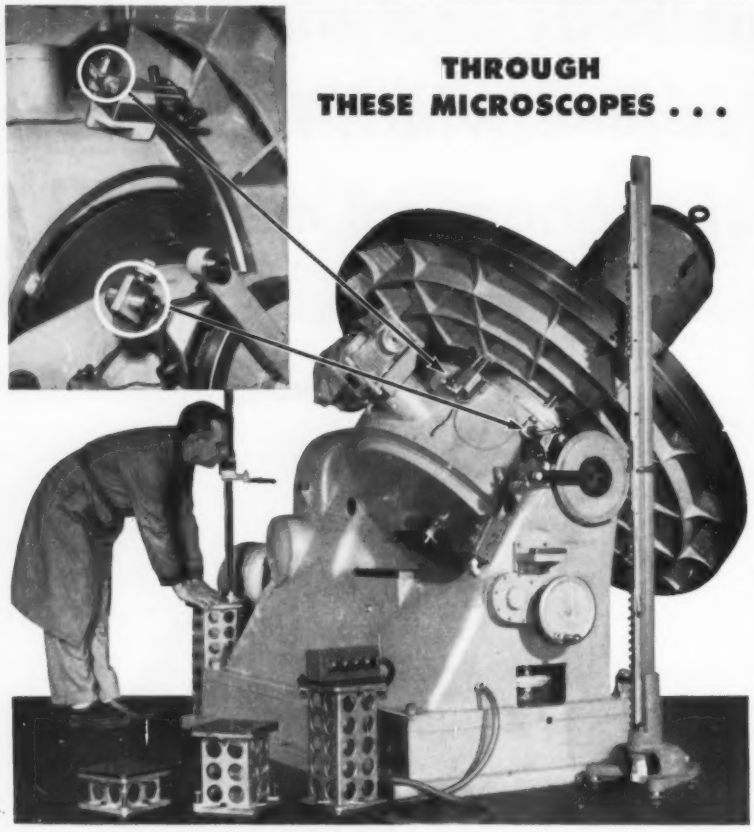

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. . . POSITIONING WITH 5 SECOND ACCURACY!

Rotary table positioning with 5 second accuracy? Amazing! And when you recall that there are 1,296,000 seconds in any circle, 5 second accuracy is indeed amazing, but *true* . . . with ROTAB tiltable rotary tables. For by incorporating optical measuring systems into ROTAB design, full 360° radial positioning, 90° angular settings are easily achieved with this fine degree of precision . . . and repeat settings within one second of arc are standard procedure!

Microscopic accuracy is just one unique ROTAB feature. In addition, motor powered rotating and tilting, easy-to-use portable controls, horizontal loading vastly improve efficiency . . . to a point, in fact, where 50% savings in set-up time *alone* are not unusual. You can use ROTAB, moreover, for inspection and quality control operations or for tool room machining. In a nutshell, ROTAB gives you precision positioning, cost-cutting efficiency and a wide range of application versatility. Ask about ROTAB today!

Faceplate diameters in 12", 24", 36", 48", 60", 72" and 84" sizes. Send for FREE catalog today.

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Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit, Inc., Akron, N. Y.

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Wales-Strippit, Inc., Akron, N. Y.

DIES, Self-opening Threading

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Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

DIES, Thread Cutting—See Stocks and Dies

DIES, Thread Rolling

Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

DISINTEGRATORS

Cincinnati Milling & Grinding Mchs. Inc., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.

DIVIDERS AND TRAMMELS—See Layout and Drafting Tools

DIVIDING HEADS—See Indexing and Spacing Equipment

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DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

DRAWING COMPOUNDS

Oakite Products Inc., 26 Rector St., New York 6, N. Y.

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

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DoALL Co., Des Plaines, Ill.

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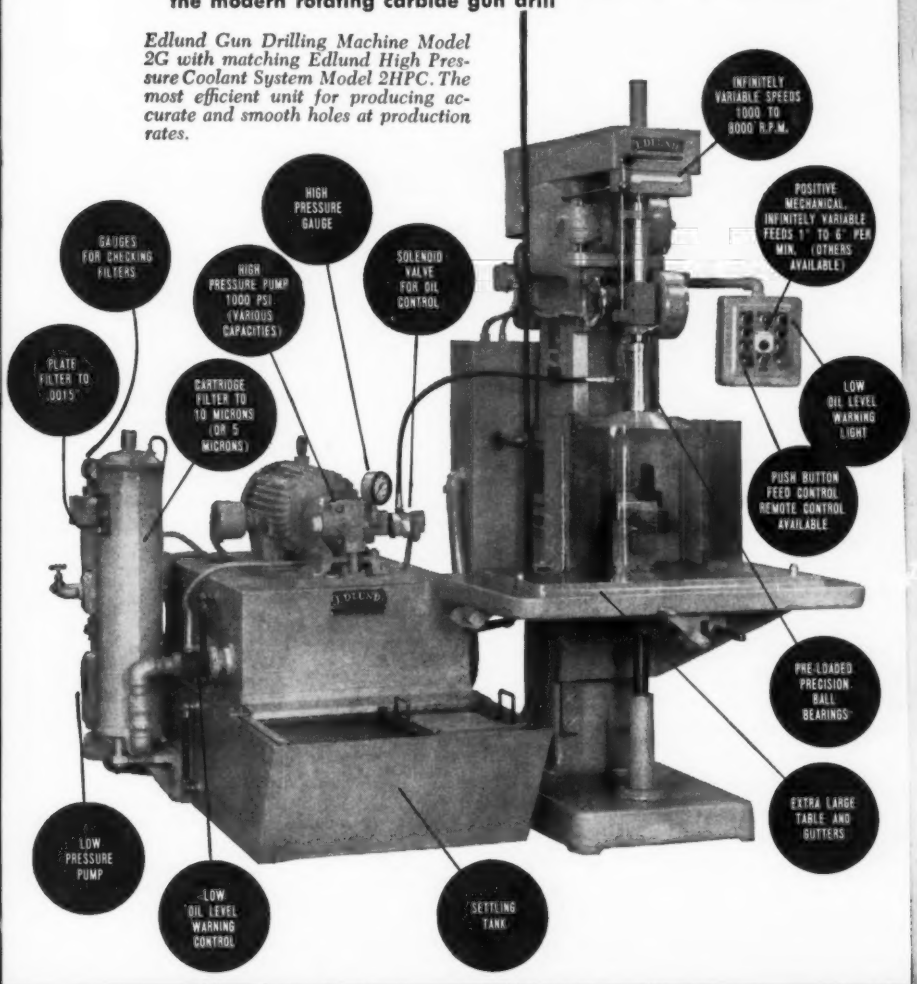
- **The only machine offering features to utilize the full potential of the modern rotating carbide gun drill**

Edlund Gun Drilling Machine Model 2G with matching Edlund High Pressure Coolant System Model 2HPC. The most efficient unit for producing accurate and smooth holes at production rates.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HIGH PRESSURE GAUGE
GAUGES FOR CHECKING FILTERS
HIGH PRESSURE PUMP 1000 PSI (VARIOUS CAPACITIES)
SOLENOID VALVE FOR OIL CONTROL
POSITIVE MECHANICAL INFINITELY VARIABLE FEEDS 1" TO 6" PER MIN. (OTHERS AVAILABLE)
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LOW OIL LEVEL WARNING LIGHT
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PRE-LOADED PRECISION BALL BEARINGS
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LOW PRESSURE PUMP
LOW OIL LEVEL WARNING CONTROL
SETTLING TANK

SPECIAL CONSTRUCTION

Pre-loaded precision ball bearing spindle keeps thrust and radial tolerances to minimum; rigidity of construction throughout to take advantage of the latest development in gun type drilling.

HIGH PRESSURE COOLANT SYSTEM

Adequate Filtration (Two filters plus settling tank guarantees clean oil essential for gun drilling) *Oil Sight Gauge *Low Level Warning System *Indicating Gauges and Provision for cooling by water or refrigeration *Capacities—reservoir 140 gals.—pump 10, 20 or 40 gals. per min. *Pressures—1000 psi.

FEATURES

- **Infinitely Variable Speeds 1000 to 8000 R.P.M. (Others available)**
- **Infinitely Variable Feeds 1" to 6" per min. (Others available)**
  (DC Motor—Positive Mechanical Control
  Remote or automatic cycling available)
- **Finishes—4 to 8 Micro Inches in most materials**
  (Eliminates Second Operations: Reaming, Grinding, Honing)
- **Capacity—⅝" in steel; Traverse of Spindle 8"; Traverse of Table 15"**
- **Single or Multiple Spindle Machines**

Contact the Edlund Representative in your area or write direct for Bulletin 2G and complete information on the Vertical Gun Drilling Machine.

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EDLUND
MACHINERY COMPANY Cortland, New York
Division of Harsco Corporation

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
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Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

DRILL SLEEVES AND EXTENSION HOLDERS

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLING ATTACHMENTS, Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

DRILLING AND BORING UNITS, Self-contained

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Automatic

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.

DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Berthiez, Charles, 5 Rue Montalivet, Paris, France
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester, Mass.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Carlton Mch. Tool Co., 2961 Meeker St., Cincinnati 25, Ohio.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

DRILLING MACHINES, Sensitive

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

DRILLS, Center

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

DRILLS, Core

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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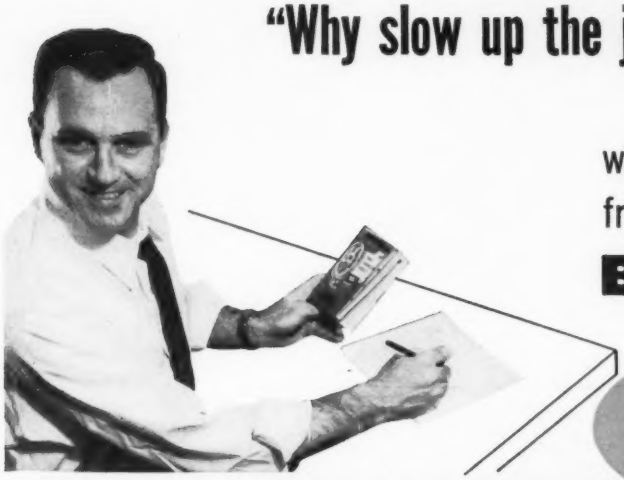

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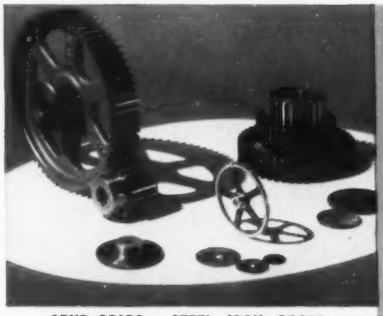
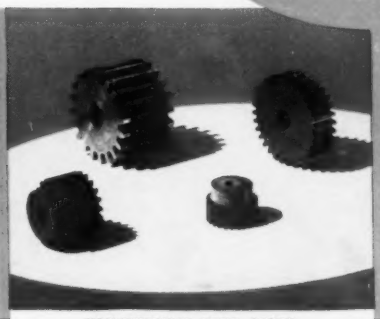
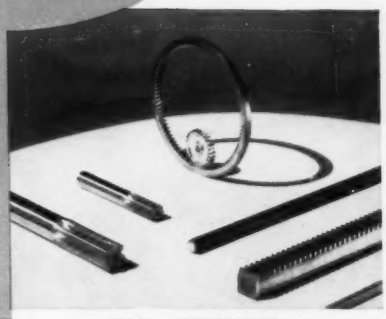


SPUR GEARS — STEEL, IRON, BRASS
14½° and 20° P.A. .208″ to 40″ P.D.



NON-METALLIC SPUR GEARS
14½° and 20° P.A. .938″ to 6.667″ P.D.



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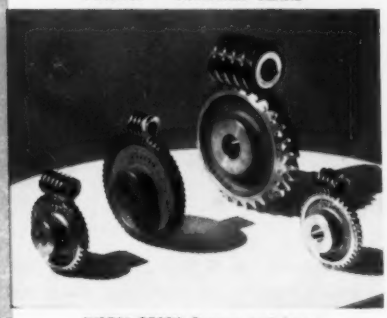

WORM GEARS Bronze and Iron
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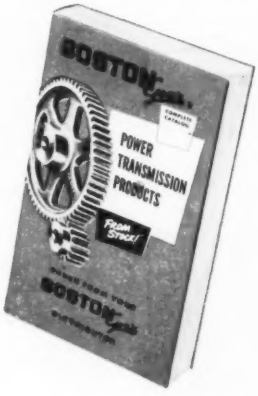

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Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Oil Hole, Oil Tube
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

DRILLS, Portable Electric
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Portable pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.

DRILLS, Ratchet
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

DRILLS, Subland
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio

DRILLS, Twist, High-Speed Steel, Carbon Steel
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Twist, Carbide, Carbide-Tipped
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

DRILLS, Wire
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

DUPLICATING ATTACHMENTS—See Tracing Attachments

DUST COLLECTORS AND CONTROL SYSTEMS
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio.

ELECTRICAL DISCHARGE MACHINES
—See Distintegrators

ELECTRONIC CONTROL SYSTEMS
Electronic Control Systems, 2231 S. Barrington Ave., Los Angeles 64, Calif.

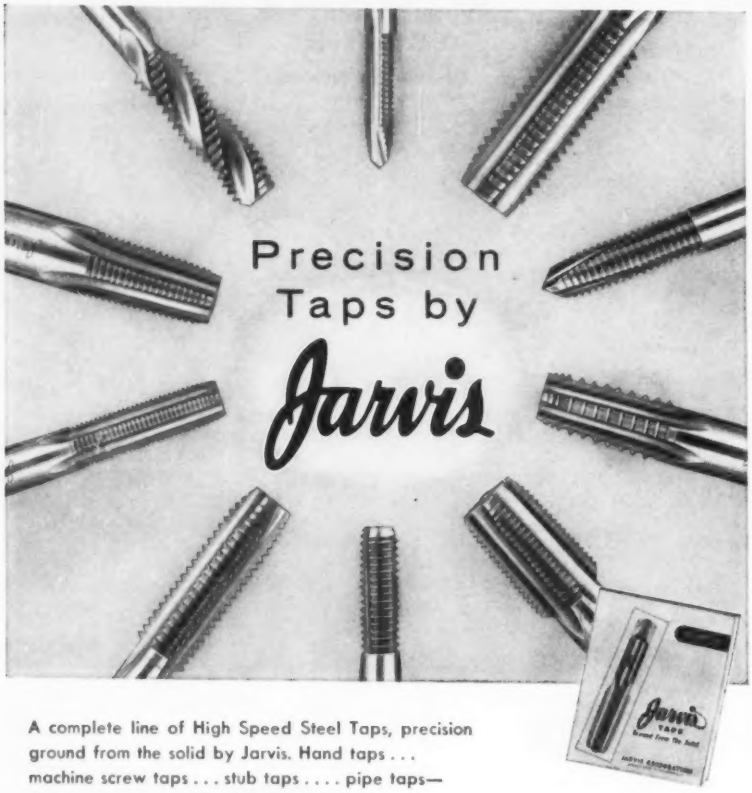
ENGRAVING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

EXTRACTORS, Screw
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FACING HEADS
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Cross Co., 3250 Bellevue, Detroit 7, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

FANS, Exhaust, Ventilating
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

FASTENERS
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.



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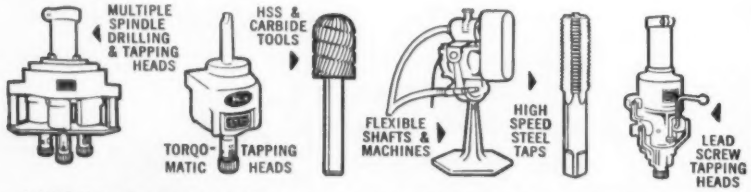
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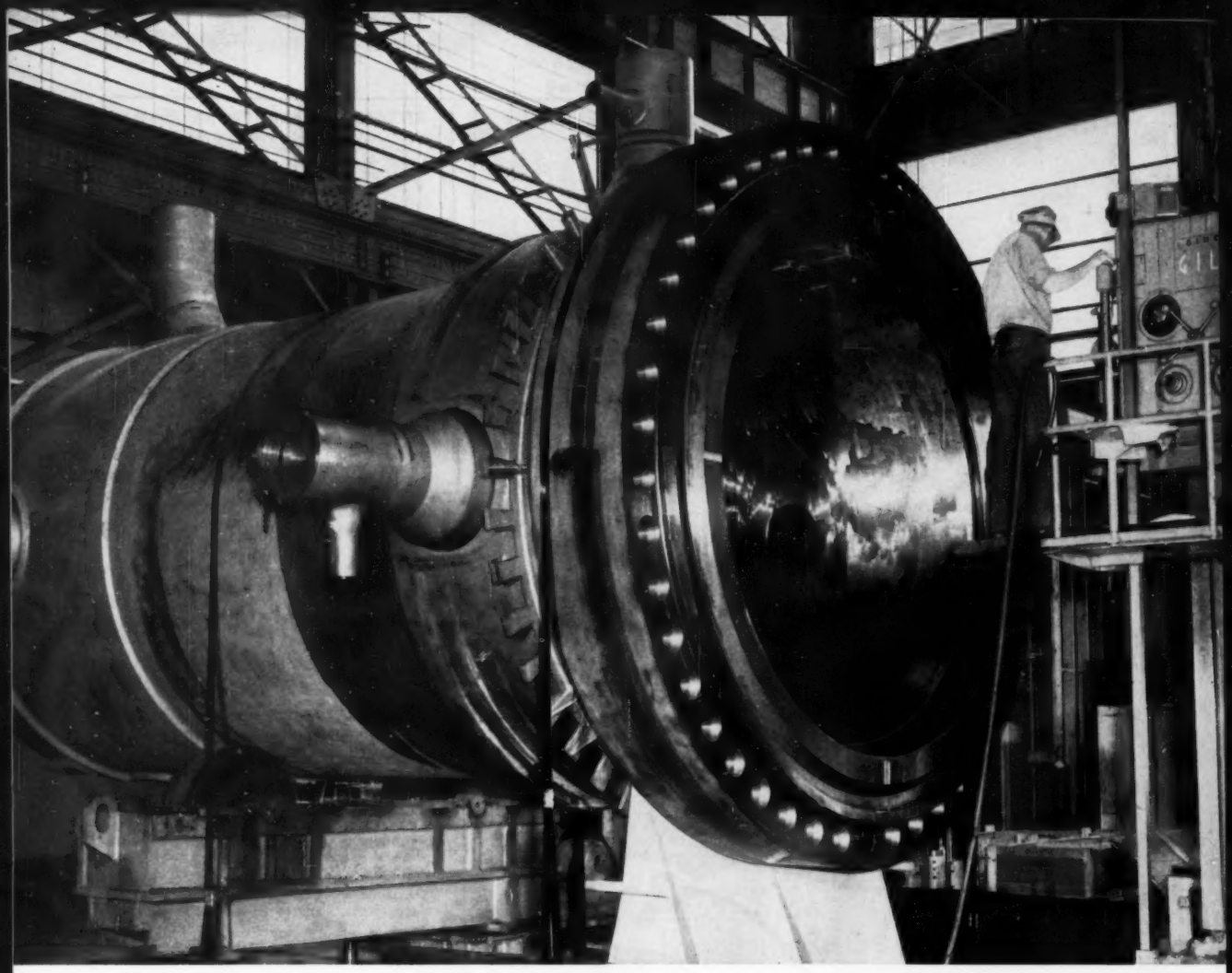

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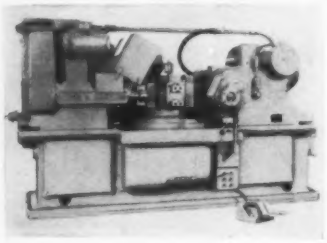

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DoAll Co., Des Plaines, Ill.

FILES, General-purpose, Swiss Pattern
DoAll Co., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES AND BURRS, Rotary
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.

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Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

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Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

FORGING, Hollow-Bored
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

FORGINGS, Drop
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

FORGINGS, Press
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
Vanadium-Alloys Steel Co., Latrobe, Penna.

FORGINGS, Upset
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Vanadium-Alloys Steel Co., Latrobe, Penna.

FORMING MACHINES, Cold-Rolling
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

FORMING MACHINES, Multiple-slide

Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65 St., Chicago 38, Ill.
U. S. Tool Co., Inc., 255 North Main St., Ampere, E. Orange, N. J.

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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

GAGES, Air Comparator

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Automatic Sorting

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, DIAL, Bore, Height, Depth, Thread, Groove, etc.

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

GAGES, Electric Comparator

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Grinding

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, Machinists' Hand, including Center, Cutter Clearance, Drill Point, Drill Size, Planer, Radius, Screw Pitch, Taper Telescoping Thickness

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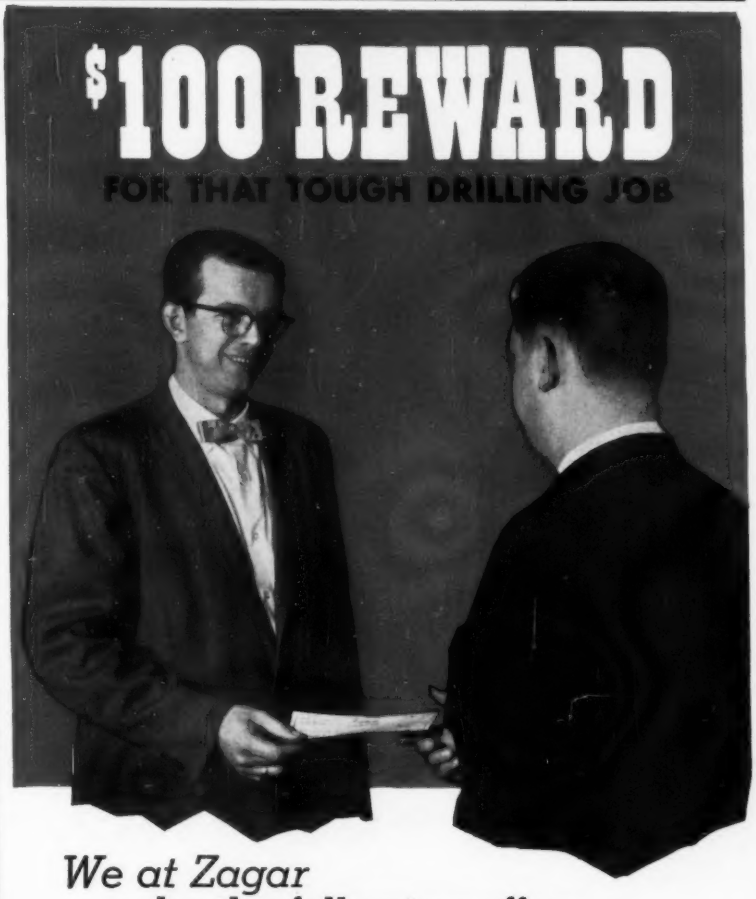
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

GAGES, Multiple Inspection

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio



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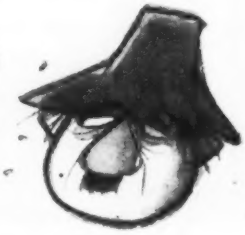

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Winter Bros. Co., Rochester, Mich.

GAGES, Roll Thread Snap, Adjustable Snap
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

GAGES, Surface Roughness
DoAll Co., Des Plaines, Ill.
Sheffield Corp., Box 893, Dayton 1, Ohio

GAGES, VERNIER, Height, Depth, Gear Tooth
Brown & Sharpe Mfg. Co., Providence, R. I.
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Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Starrett, The L. S., Co., Athol, Mass.

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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33 Penna.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
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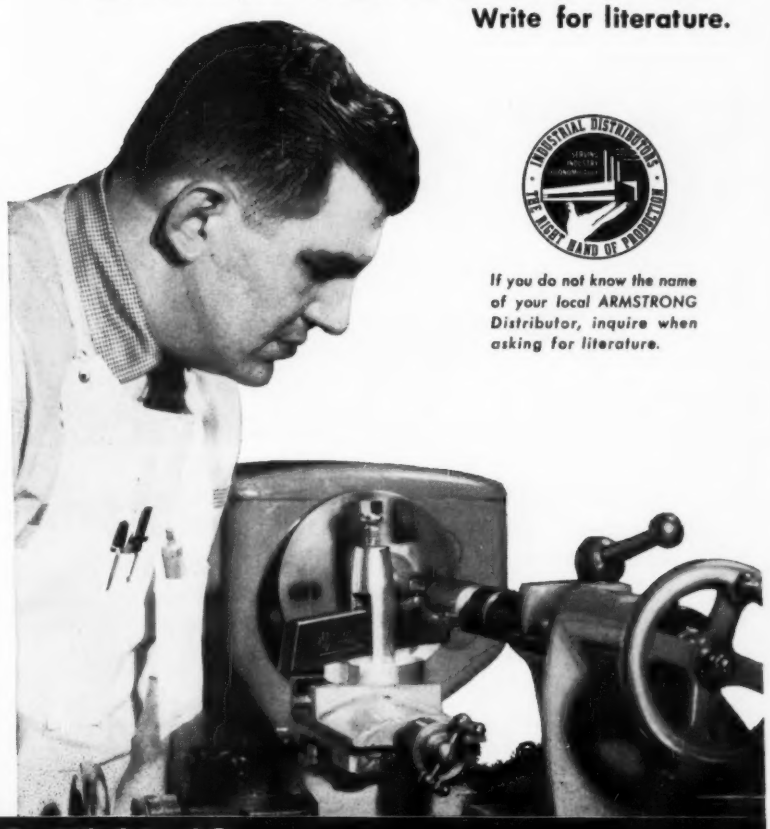

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(Continued on page 246)

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What are the advantages of reverse current for electrocleaning steel? *See page 15.*

For electrocleaning nonferrous metals, what are relative advantages of cathodic, cathodic-anodic and soak-anodic cleaning? *See page 17.*

Can you electroclean brass without tarnishing? *See page 18.*

How do bright dips make metals brighter? *See page 21.*

Can you clean steel and condition it for painting for less than 20 cents per 1,000 square feet? *See page 24.*

Would you like a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 28.*

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Does your burnishing barrel produce a luster you are proud of? *See page 32.*

What do you do when the overspray neither sinks nor floats in the wash water in your paint spray booth? *See page 35.*

Do you dry steel parts before anti-rusting? *See page 37.*

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Horsburgh & Scott Co., 5114 Hamilton Ave., Cleveland 14, Ohio
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Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio
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Mummert-Dixon Co., Hanover, Pa.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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GRINDERS, Die and Mold
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDERS, Drill Point
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Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.

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Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mattison Machine Works, 545 Blackhawk Park Ave., Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

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Mummert-Dixon Co., Hanover, Pa.
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Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDERS, Portable Pneumatic
Chicago Pneumatic Tool Co., New York 17, N. Y.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Madison-Kipp Corp., Madison, Wis.

GRINDERS, Tap
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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh, Pa.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
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Gorton, Geo., Mch. Co., 1321 Racine St., Racine, Wis.
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LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
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Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio

GRINDERS, Toolpost
Cosa Corp., 305 Lexington Ave., New York 17, N. Y.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING GAGES—See Gages, Grinding

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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Mch. Works, Rockford, Ill.
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National Broach & Mch. Co., 5600 St. Jean, Detroit 13, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Thompson Grinder, 1534 W. Main, Springfield, Ohio

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Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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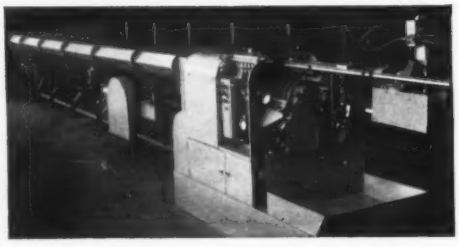

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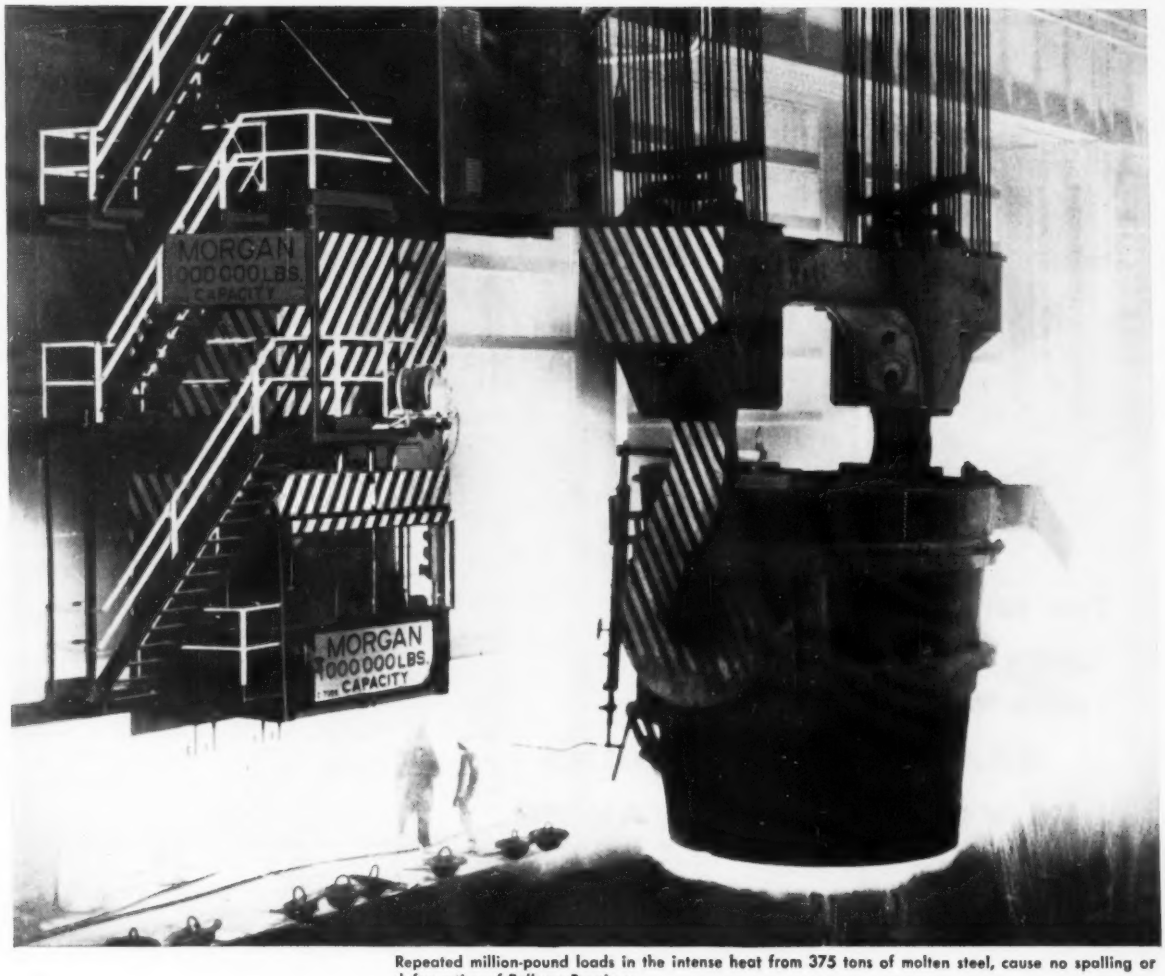

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Norton Co., 1 New Bond St., Worcester 6, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio
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Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh 8, Pa.
Gardner Machine Co., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

GRINDING MACHINES, Gear

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Gear Grinding Mch. Co., 3901 Christopher St., Detroit 11, Mich.
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National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio.
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Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

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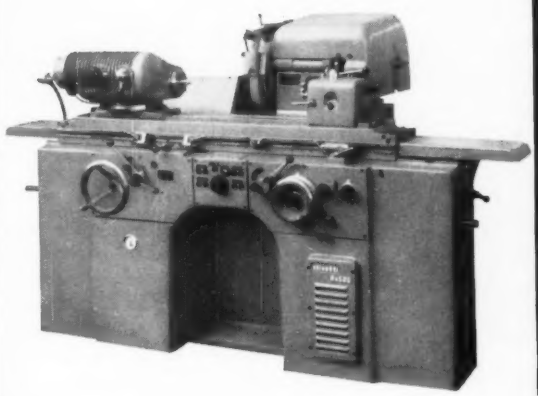

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PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

PLUNGE. *Similar to production type but with axially oscillating wheelhead and hand table control only.*

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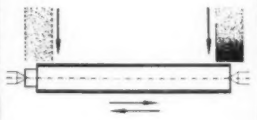
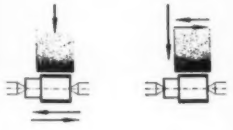
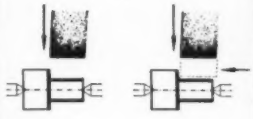
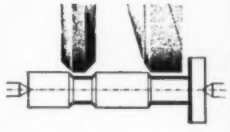
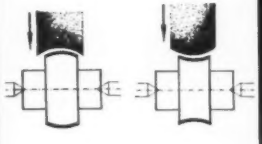
Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.











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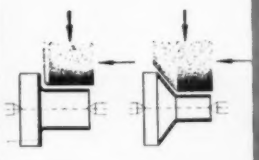

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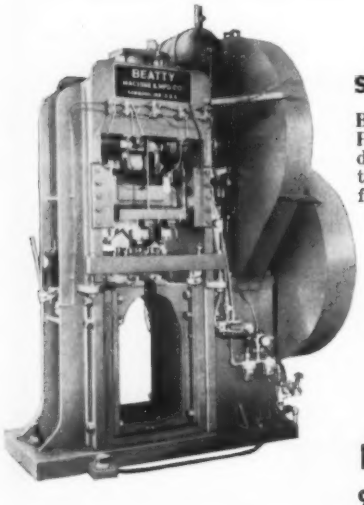

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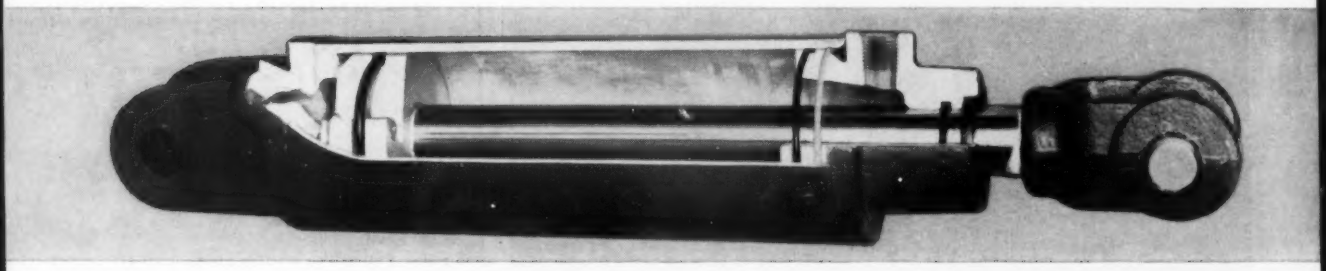

such as plows, cultivators, and disc harrows. This cylinder uses your Shelby Seamless Mechanical Tubing with the I.D. bored to size and roller burnished to a finish of approximately six to eight RMS. The expected life of this cylinder is in excess of 300,000 cycles, operating at 1,500 psi hydraulic pressure.

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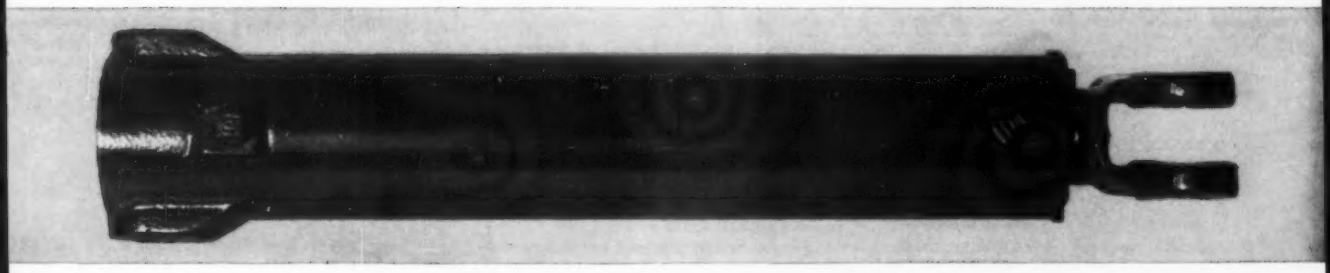

with respect to finish requirements and material for the barrel. The operating pressure is approximately the same and so is the expected service life of five years, or 300,000 cycles. Generally these cylinders may be serviced for additional use by merely replacing the seals.

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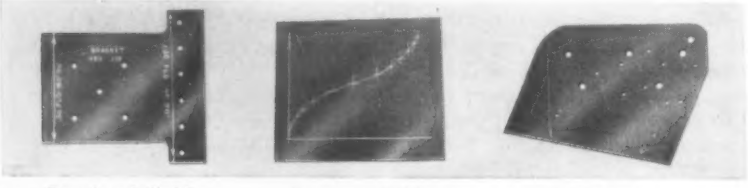

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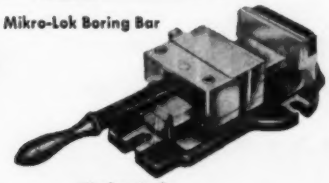

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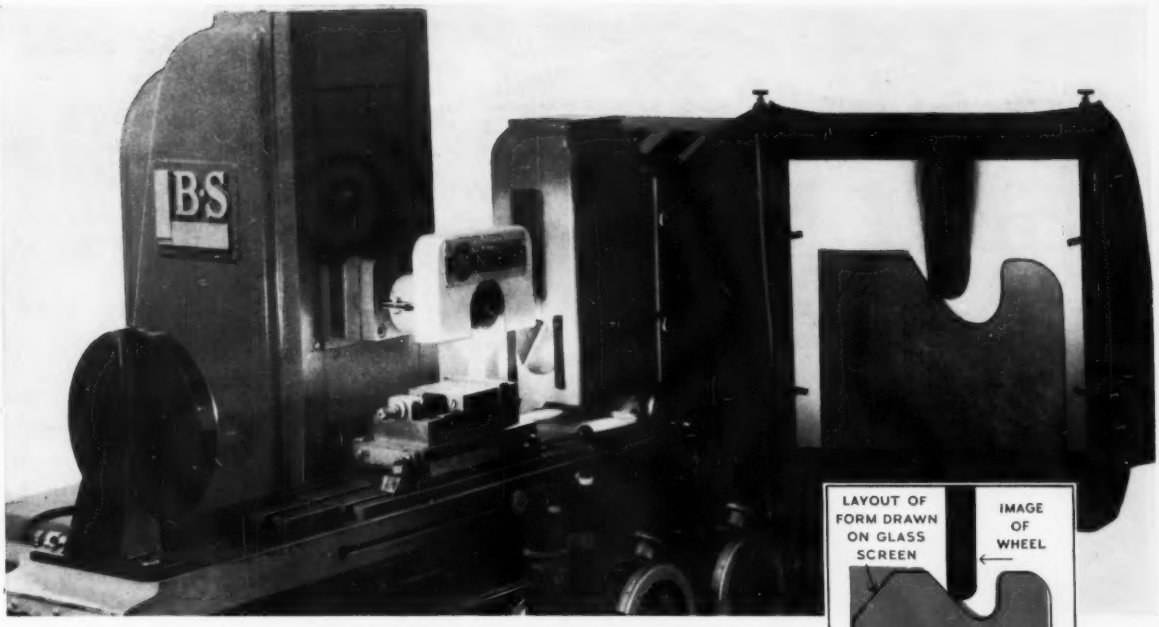

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Now, the MICROMASTER Visual Grind brings you these proved advantages *plus* the profit-saving performance of the new Brown & Sharpe 618 Surface Grinding Machine.

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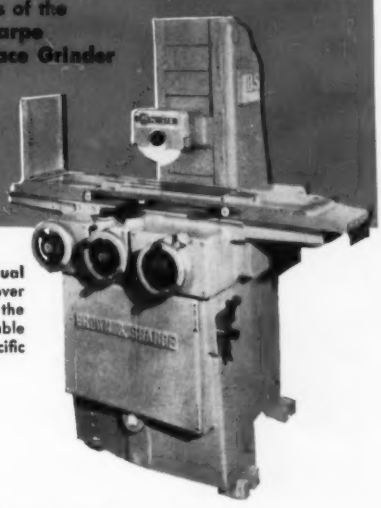
Hydraulic table speeds of the NEW Brown & Sharpe 618 MICROMASTER Surface Grinder

provide the smooth longitudinal power stroke essential to Visual Grind efficiency. The operator easily follows form with the transverse and vertical handwheels, using .0001 feeds when required.



MICROMASTER Visual Grind is one of over 100 modifications of the new B&S 618 available to meet your specific grinding needs.

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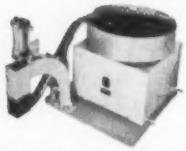
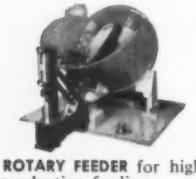


VIBRATORY FEEDER for light, fragile or highly finished parts.



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ROTARY HIGH SHELL FEEDER for maximum holding capacity.

Shuffle and deal parts for automatic assembly with DPS selective feeders

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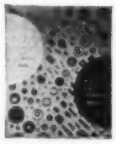

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LATHES, Crankshaft
Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End
Cleveland Automatic Machine Co., 4932 Beech St., Cincinnati 12, Ohio
Consolidated Mch., Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

LATHES, Duplicating
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

LATHES, Engine, Manufacturing
American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Coleral Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

LATHES, Hollow Spindle
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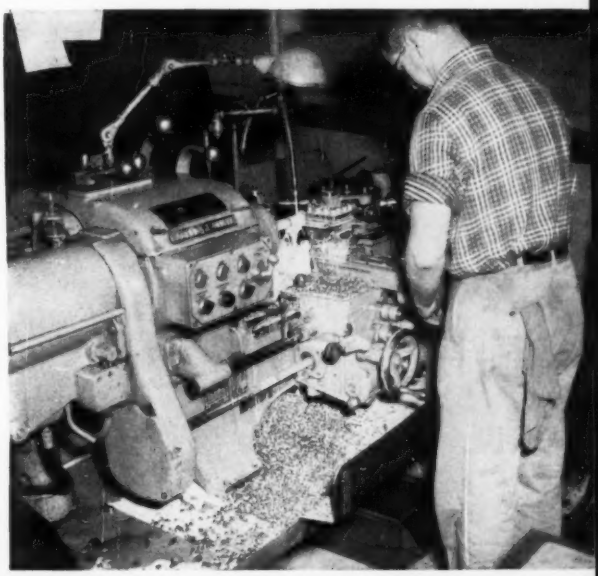

Operator Martin Hopp reports: "I can produce more with less effort from this machine than from other turret lathes of similar size. I have no trouble holding .001 inches on lengths and diameters."

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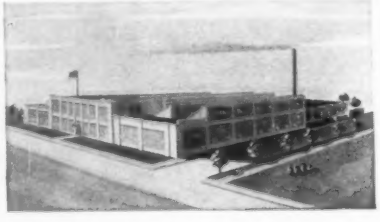

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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, 2, N. J.

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Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., 4258 N. Knox Ave., Chicago 41, Ill.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio

LATHES, Spinning
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Lodge & Shipley Co., The, Cincinnati 25, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.

LATHES, Toolroom—See Lathes, Engine, Toolroom

LATHES, Turret, Automatic
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
King Machine Tool Div., American Steel Foundreis, 1150 Tennessee Ave., Cincinnati 29, Ohio
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.

LATHES, Turret, Ram Type Saddle Type
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Bullard Co., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
New Britain Mch. Co., New Britain-Gridley Div., New Britain, Conn.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mach. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio

LATHES, Turret, Vertical—See Boring Mills, Vertical

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Starrett, L. S., Co., Athol, Mass.

LEVELS
Starrett, The L. S., Co., Athol, Mass.

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(*Continued on page 260*)

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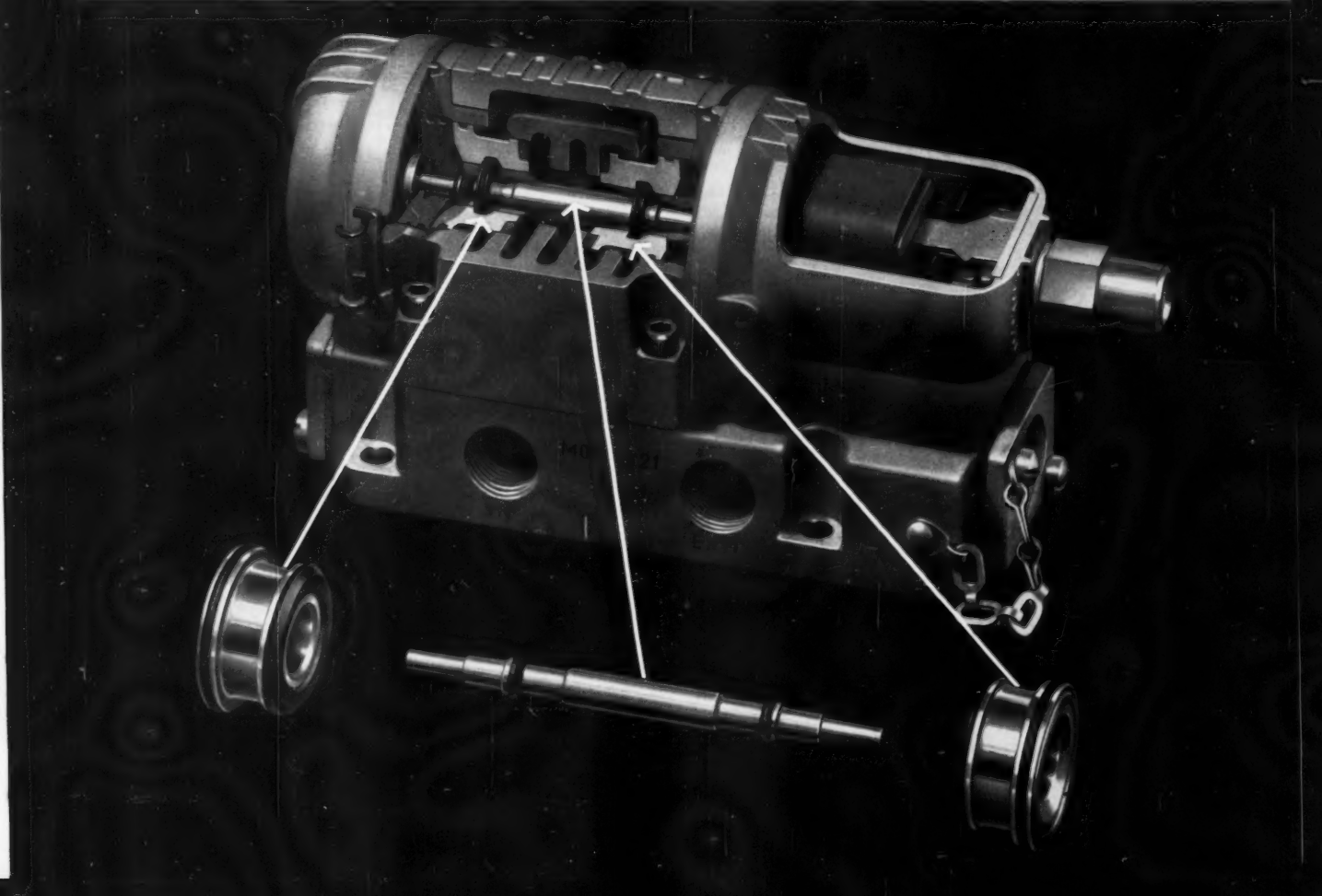

Shell Oil Co., 50 W. 50th St., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Texas Co., 135 E. 42nd St., New York, N. Y.

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Madison-Kipp Corp., Madison, Wis.

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Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

MANDRELS—See Arbors and Mandrels

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Gorton Mch. Co., 1321 Racine St., Racine Wis.

MATERIAL-HANDLING TRUCKS—See Trucks, Material Handling

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Sheffield Corp., 721 Springfield St., Dayton, 1, Ohio
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Starrett, The L. S., Co., Athol, Mass.

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
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DoALL Co., Des Plaines, Ill.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
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G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

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Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Wrks., Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Mctch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Bench, Hand
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Nichols, W. H. Co., Waltham 54, Mass.

MILLING MACHINES, Circular, Continuous
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Bullard Co., Bridgeport 6, Conn.
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

MILLING MACHINES, Knee Type Rise and Fall
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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

MILLING MACHINES, Knee Type Ram
Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Knee Type Turret
Gorton Mch. Co., 1321 Racine St., Racine, Wis.

MILLING MACHINES, Knee Type, Vertical
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 450 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

MILLING MACHINES, Planer Type
Berthiez, Charles, 5 Rue Montalivet, Paris, France
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Spar
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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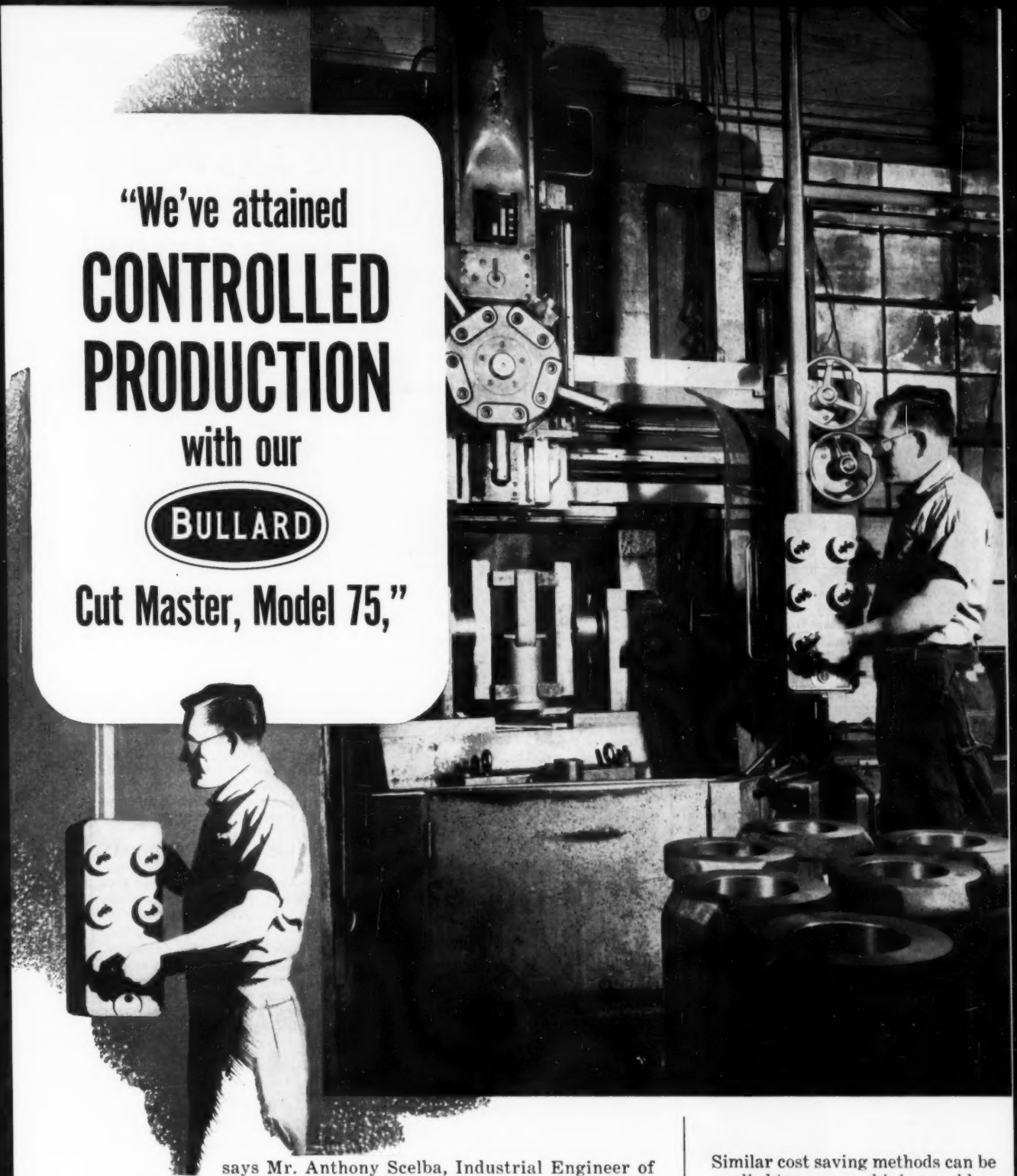
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

MOTORS, Air
Ingersoll-Rand Co., Phillipsburg, N. J.



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says Mr. Anthony Scelba, Industrial Engineer of Leslie Co., Lyndhurst, New Jersey, manufacturers of regulators and controllers for industrial and marine steam systems.

Combining a specially designed indexing fixture, which permits indexing the piece in increments of 45° and with the automatic features of Cut Master, every piece leaving the machine is completely finished on all surfaces. This reduces the number of set-ups, for instance, on a four way valve from four set-ups to one. In this manner, production is controlled and a minimum inventory required.

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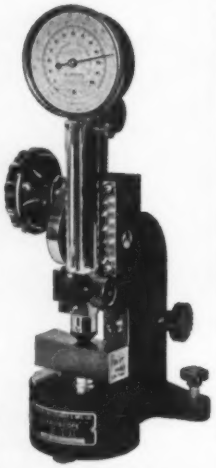
Shore's Improved Direct Reading Scleroscope (above) and Standard Recording Scleroscope (below) with dial graduated in standard Scleroscope and equivalent Brinell and Rockwell "C" Hardness Numbers, are able to perform over 1000 hardness tests per hour. Both Scleroscopes are completely portable, operative on all types and sizes of metals, are reliable in hands of non-technical help, and show no visible injury signs on finished surfaces. Write for free brochures on these instruments.



Direct Reading Scleroscope shown above with special Swing Arm & Post Assembly. Height capacity 9", reach 14". To be mounted on bench for testing large objects. Supplied with two test blocks and diamond hammer.

Standard Recording Scleroscope (right) with Clamping Stand, jaw capacity 3" high x 2⅛" deep. Supplied with following accessories: diamond hammer, hard and soft test block, V block for testing rounds, and steel carrying case.

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

MULTIPLE INSPECTION GAGES—See Gages, Multiple Inspection

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Cross Co., 3250 Bellevue, Detroit 7, Mich.
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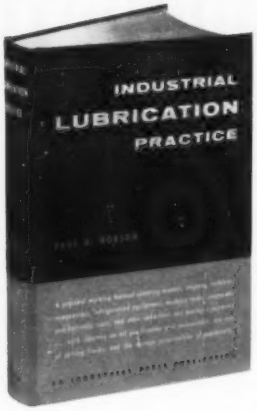

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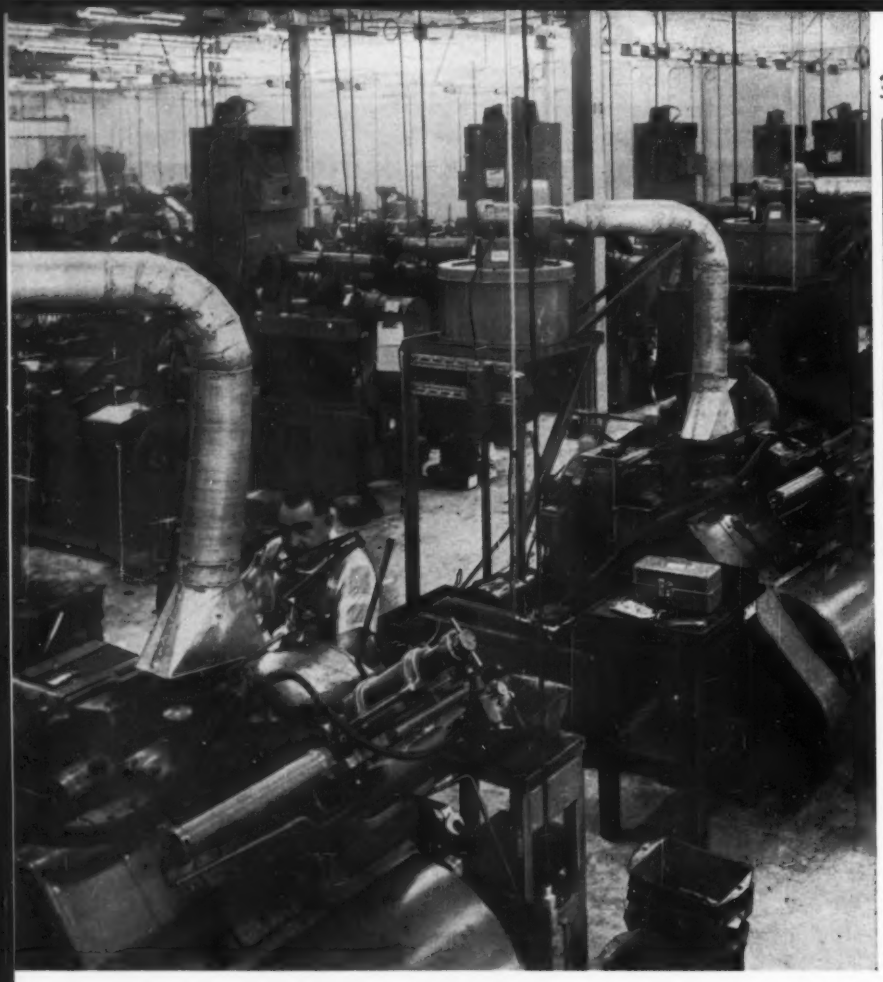

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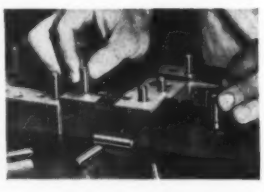

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Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
Northern Hydraulics & Mach. Corp., Melrose Park, Ill.

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
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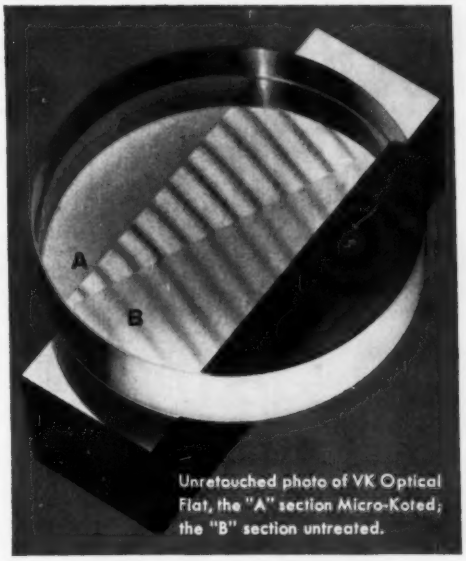

Unretouched photo of VK Optical Flat, the "A" section Micro-Koted; the "B" section untreated.

VAN KEUREN MICRO-KOTED* OPTICAL FLAT

Elimination of the fuzzy edges of the interference bands gives you *greater precision* and *readability*... and faster checking, too, because you get the pattern quicker. There's stronger contrast, a brighter field. The narrow band, very black and sharp-edged, has a width corresponding to a height difference of about .000001".

Having several times the effectiveness of ordinary flats, you might think that VK Micro-Koted Optical Flats are expensive — but that's where you'd be wrong. They cost only 10% to 15% more than uncoated flats. They do not require special handling; they have amazingly long life. One user checked more than 10,000 pieces of permanent magnetic material (carbon seals and Alnico seals) without any appreciable wear. Speaking of VK Micro-Koted Flats, one man said, "It makes a hell of a difference! We wouldn't buy a flat *unless* it was Micro-Koted!" That's the kind of compliment that makes us do our best!

Originated by Van Keuren in 1957, these Micro-Koted flats are perfect for checking bronze, brass and other metals used for magnetic seals, and for checking other critical parts, for surface flatness.

Write today for descriptive leaflet, "Micro-Koted Flats".

* VK Micro-Koted Optical Flats are treated on one side with a transparent layer of hard metal.

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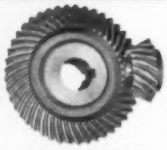
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio

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Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
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Minster Machine Co., Minster, Ohio
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Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
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Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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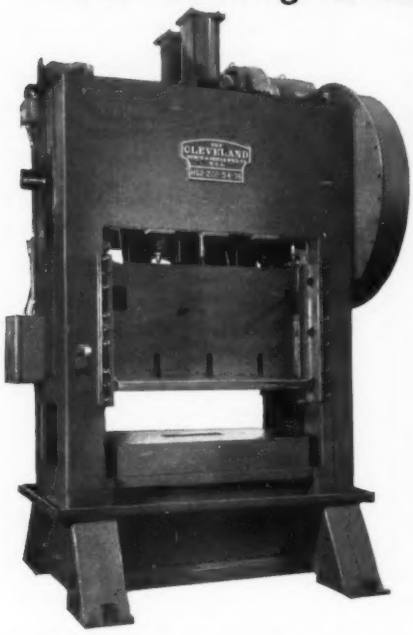
CLEVELAND

Cost-Cutting PRESSES



Cleveland high-speed Double Eccentric Press, 200-ton capacity, operates at 50 to 150 strokes per minute for high-speed punching, shearing, perforating, bending and forming.

Are production breakdowns, slow outmoded presses and mounting maintenance costs destroying your profits? A check of your press performance records may show you're already paying for new presses . . . *without their benefits.*

For lower operating costs, quicker starting, increased production, investigate the new minimum-maintenance Cleveland Presses. Our engineers are ready to help you plan a program of replacing old inefficient presses with modern cost-cutting Cleveland Presses of the exact type, size and capacity to meet your need.

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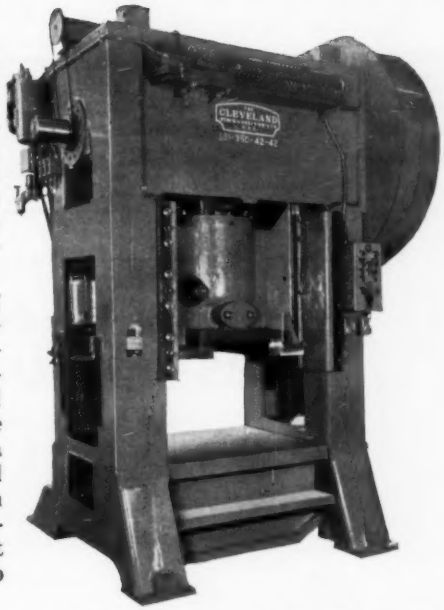

Cleveland's cost-cutting Single Eccentric Press, 350-ton capacity, operates at 60 strokes per minute, has air-counterbalanced slide and auxiliary air brake on flywheel.

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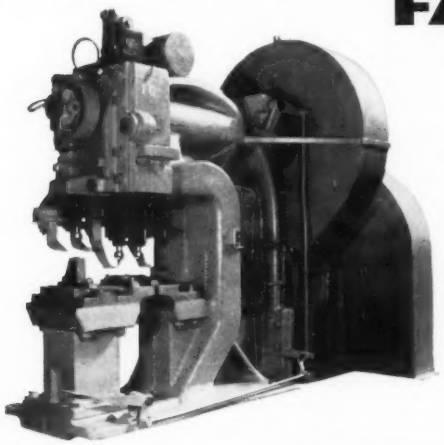

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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
V & O Press Co., Hudson, New York
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.

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Allen, Alva Industries, Clinton, Missouri
Beatty Machine & Mfg. Co., Hammond, Ind.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engineering Co., Wickliffe, Ohio
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Machine & Welder Co., 1745 Overland Ave., N. E., Warren, Ohio
Federal Press Co., 511 Division St., Elkhart, Ind.
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Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.
Wiedemann Machine Co., Gulph Rd., King of Prussia, Penna.

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Gleason Wks., 1000 University Ave., Rochester 3, N. Y.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Cincinnati Milling & Grinding Machines, Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9303 S. Kenwood Ave., Chicago 19, Ill.

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
Chambersburg Engineering Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38 Ill.
Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
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Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
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Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.
Minster Machine Co., Minster, Ohio
Niagara Machine & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.

PROFILING MACHINES—See Milling Machines, Die Sinking, etc.

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Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.

PUMPS, Coolant and Lubricant

Barnes, John S., Corp., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Graymills Co., 3705 N. Lincoln Ave., Evanston, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
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Brown & Sharpe Mfg. Co., Providence, R. I.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
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Cogsdill Twist Drill Co., Greenfield, Mass.
DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill.
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Jarvis Corp., Stack Ave., Middletown, Conn
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

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RIVETERS, Stationary
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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
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RULES, SCALES AND STRAIGHTEDGES
See Machinists' Small Tools

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Shell Oil Co., 50 W. 50th St., New York, N. Y

SAND BLAST EQUIPMENT—See Blast Cleaning Equipment

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Capewell Mfg. Co., 60 Governor St., Hartford, Conn.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.
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Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.

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Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio

SAWING MACHINES, Abrasive Machines—See Cutting-off Saws, Abrasive Wheel

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Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DoALL Co., 254 Laurel Ave., Des Plaines, Ill.

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Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.
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Ty-Sa-Man Machine Co., Inc., Knoxville, Tenn

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Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.

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SCREW DRIVERS, STUD AND NUT SETTERS, Power
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National Acme Co., 170 E. 131st St., Cleveland, Ohio
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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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Warner & Swasey, 6701 Carnegie Ave., Cleveland 3, Ohio

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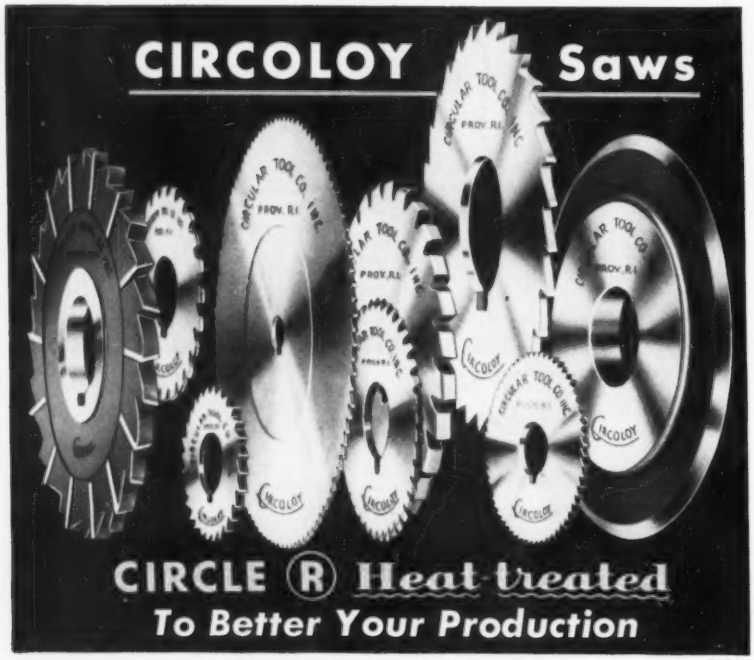
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.



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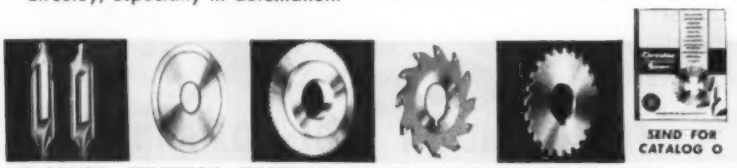

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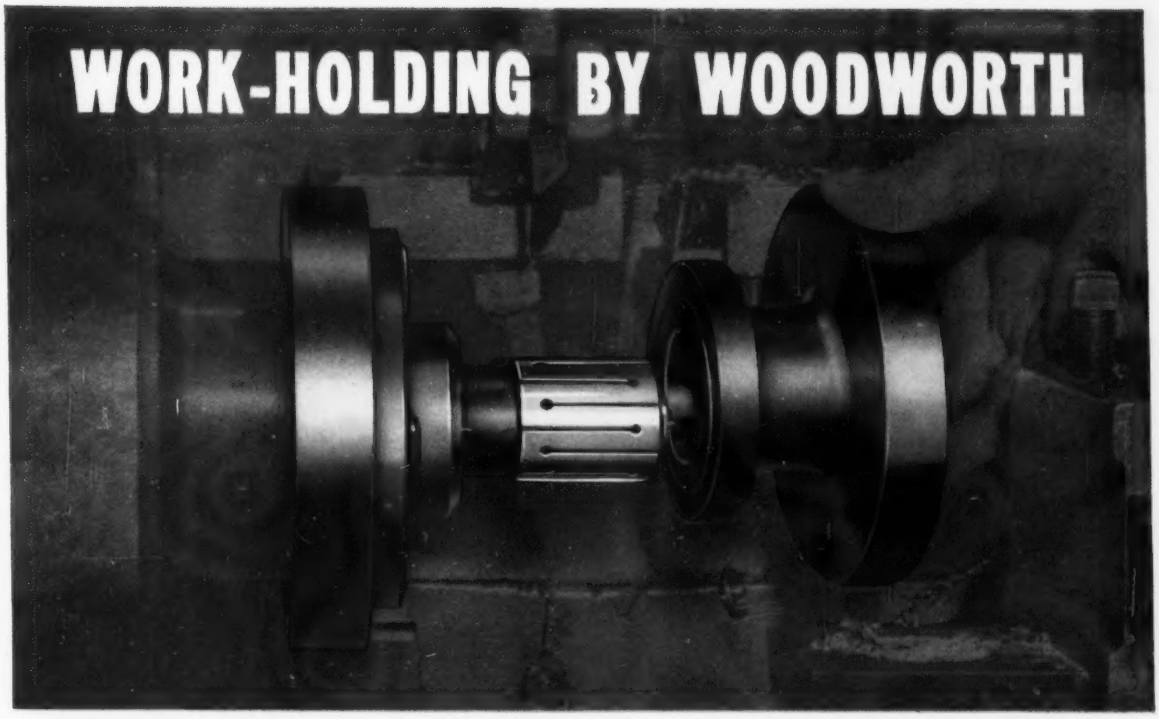

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SOCKETS—See Drill Sleeves and Extension Holders

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Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio.

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National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Standard Electrical Tool Co., 2488-90 River Road, Cincinnati, Ohio.

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SPROCKETS—See Gears, Cut

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Bethlehem Steel Co., Bethlehem, Pa.
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Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
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Vanadium-Alloys Steel Co., Latrobe, Penna.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

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Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

STRAIGHTEDGES—See Machinists' Small Tools

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U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRIP AND SHEET, Non-ferrous

American Brass Co., 25 Broadway, New York N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STRUCTURAL SHAPES

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

STUD SETTERS—See Screwdrivers, etc.

SUPERFINISHING EQUIPMENT

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

SWITCHES, Limit

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

TACHOMETERS—See Indicators, Speed

TAP HOLDERS

Brown & Sharpe Mfg. Co., 235 Promendae St., Providence 1, R. I.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.

TAPPING HEADS

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
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Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y.
Kaufman Manufacturing Co., Manitowac, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Tool & Mfg. Co., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

TAPS, Collapsing

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Landis Mch. Co., Waynesboro, Pa.
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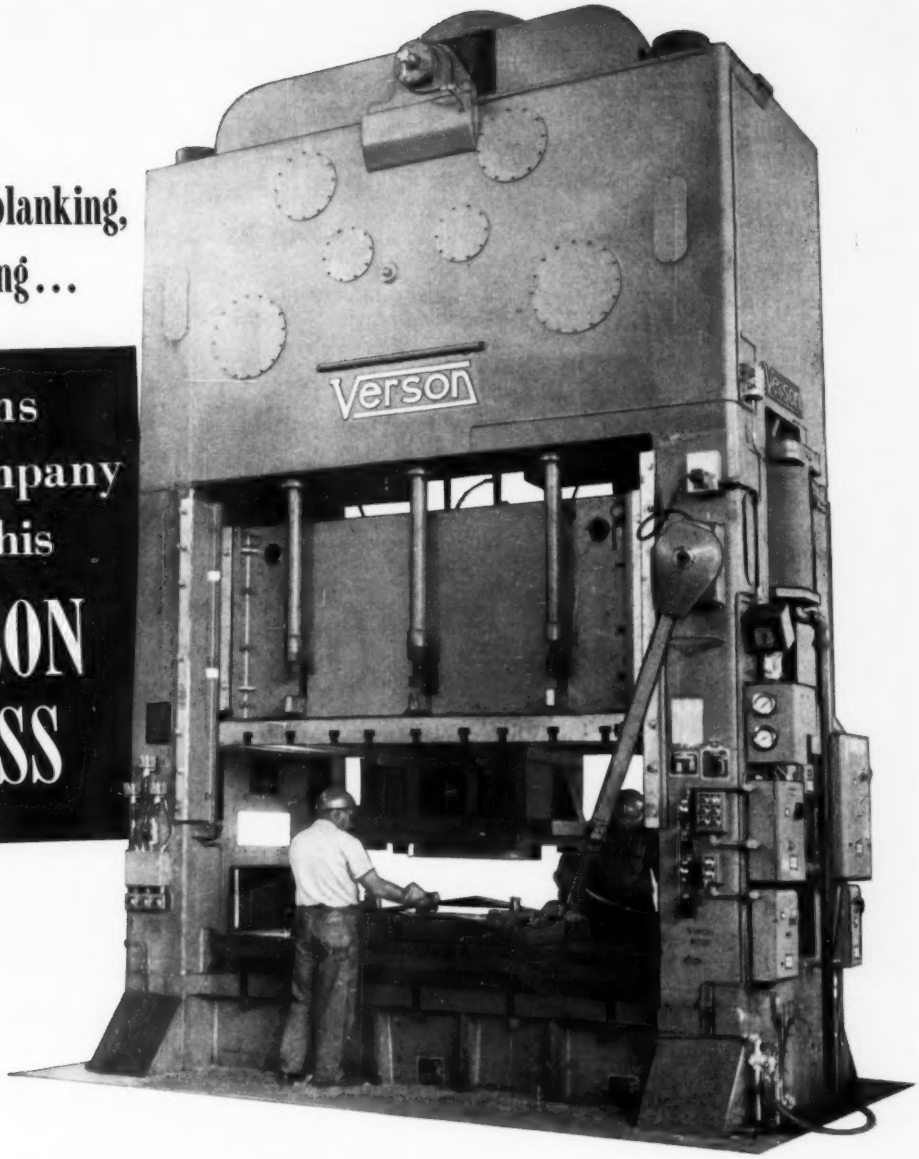

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Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

THREAD ROLLING DIES—See Dies, Thread Rolling

THREAD ROLLING EQUIPMENT
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Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
V & O Press Co., Hudson, New York
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Automatic Mch. Co., 4932 Beech St., Cincinnati 12, Ohio.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Delta Power Tool Div., 400 N. Lexington Ave., Pittsburgh 8, Pa.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y

TOOL MATERIAL, Cast Non-Ferrous Alloy
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

TOOL MATERIAL, Cemented Carbide
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

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American Tool Works Co., Pearl & Eggleston Aves., Cincinnati 2, Ohio.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit, Inc., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

TRANSFER MACHINES
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Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Reliance Electric & Engineering Co., 1200 Ivanhoe Rd., Cleveland 10, Ohio.
Vickers, Inc., Detroit 32, Mich.

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Metal Forming Corp., Elkhart, Ind.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Metal Forming Corp., Elkhart, Ind.
National Tube Div., U. S. Steel Corp, 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
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Sheffield Corp., Box 893, Dayton 1, Ohio.

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Barnes, John S. Corp., Rockford, Ill.
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Vickers, Inc., Detroit 32, Mich.

VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Mechanical Air Controls, Inc., Oak Park, Mich.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Electric Valve Div., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

VERNIERS—See Calipers, Vernier; Gages, Vernier

VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
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Linde Co., 30 E. 42nd St., New York 17, N. Y.

WELDING EQUIPMENT, Resistance
Eisler Engrg. Co. Inc., 750 South 13th St. Newark, N. J.
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Bliss, E. W. Co., Canton, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

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Allegheny Ludlum Steel Corp., Pittsburgh, Pa (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.
Vanadium-Alloys Steel Co., Latrobe, Penna.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

WOODWORKING MACHINES
Delta Power Tool Div., Rockwell Mfg. Co., 400 N. Lexington Ave., Pittsburgh, Pa.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

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Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
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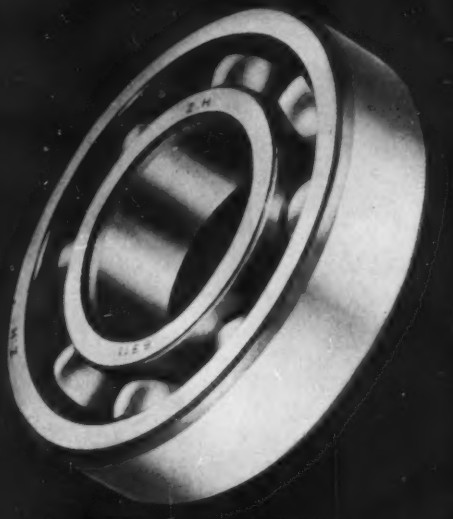

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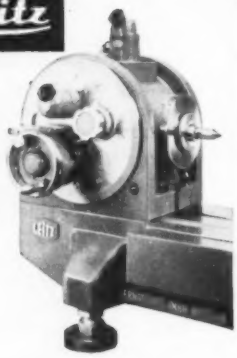

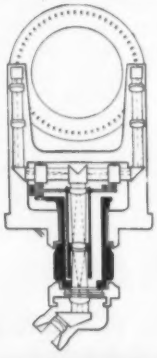

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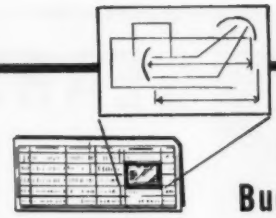

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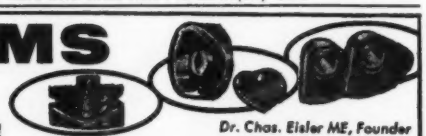

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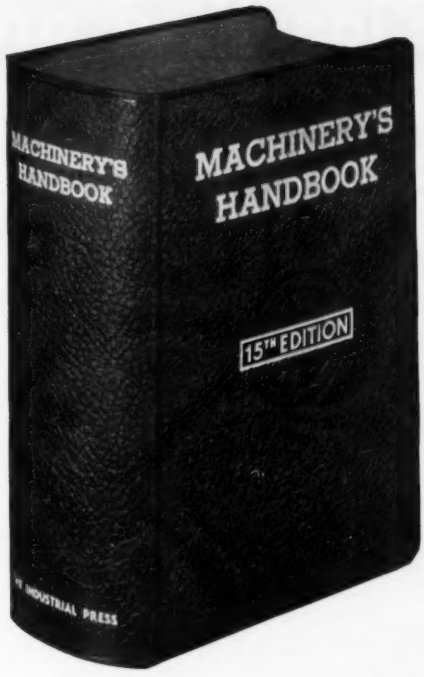

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4 spindle 2" Model K Cleveland, m.d.
2¼" Cleveland m.d., Model A
No. 4D Potter & Johnston, m.d., late
No. 5DELX Potter & Johnston, m.d., late
No. 5D2 Potter & Johnston, m.d.
5⅝" Cleveland Model A Single Spindle, m.d., late

BOLT THREADERS
Victor Nut Facing Machine, m.d., cap. ⅝" to 2" nuts
1½" Landis 2 spindle, m.d.
1½" Landis Bolt Threading Machine, double head stay bolt, m.d.

BOREMATICS
No. 44 Heald Facing Type Borematic, m.d.
No. 47A Heald Single End, m.d.
Model DB-102 Excello Double End Boring Machine, m.d.

HORIZONTAL BORING MILLS
No. 25T Giddings & Lewis, m.d.
No. 32 Lucas Table Type, m.d.
No. 1 Cleveland Horizontal Boring, Drilling & Milling, m.d.
3⅛" bar Cincinnati Gilbert Horizontal, Boring, Drilling & Milling, floor type
Barrett Double End, 5" and 7" spindle, m.d.
4½" bar, Model 72, Niles-Bement-Pond, m.d.
5⅞" bar Niles-Bement-Fond, m.d.
6" bar Sellers Floor Type, m.d.

VERTICAL BORING MILLS
16" Bullard Mult-au-matic, m.d.
24" Bullard Spiral Drive, m.d., 1943
36" Bullard, m.d., late 1944, Spiral Drive
36" Bullard, m.d.
42" King, m.d.
42" Bullard, New Era, m.d.
44" Putnam, m.d., p.r.t.
52" Niles Heavy Pattern, m.d., p.r.t.
53" Niles Heavy Pattern, vee belt m.d., latest, 60" under rail
60" Bullard, m.d.
120" Niles, m.d.

BROACHING MACHINES
12x72" Thompson Automatic Flat Broach, m.d.
10 ton, 84" stroke LaPointe Single Ram Vertical Surface Broach, m.d., late
Type SBD-42-6 American Vertical Hy. Dup. Broach
Type SBD-48-15 American Vertical Dup. Ram Surface Hy. Broach

RADIAL DRILLS
3'17" col. Cincinnati, direct m.d.
4'-11" col. Carlton, m.d.
4'-13" col. American Hole Wizard, m.d.
4'-13" col. Fosdick, 1944
4'-15" col. Cincinnati-Bickford, m.d.
6'-17" col. American Triple Purpose, m.d.
7'-16" col. American Triple Purpose, m.d.
8'-17" col. Dreses, gear box m.d.
Baush Radial Drilling & Tapping Machine, m.d.

BALL BEARING DRILLS
No. 4 Fosdick, 8" overhang, m.d., H.S.
No. ⅓ Avey MA8, m.d.
No. 2 Avey, m.d.
No. 1B Edlund, m.d., new
No. 4BM Fosdick, single spindle, H.S., m.d.
No. 4MS Leland & Gifford H.S., 4 spindle A.C., m.d.
1 spindle No. 2MA6 Avey H.S. Type B, m.d., 7½" overhang 1943
No. 2B-8" H.D. Edlund, H.P., m.d.
2 spindle Atlas Bench Type, 1942
2 spindle Allen, belted m.d., 8" overhang
2 spindle No. 2 Avey H.S., belted m.d.
2 spindle No. 2BMA, 1 Avey Production Type, m.d.
2 spindle No. 3 MA6 Avey H.S., m.d.
2 spindle No. 2 Leland & Gifford H.S., 8" overhang, m.d.
2 spindle Leland-Gifford H.S. Hydraulic Type, m.d.
No. 2LMS Leland-Gifford, single spindle, H.S., m.d.
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3 spindle No. 3 Morse Taper, Foote-Burt "Sipp" H.S., m.d.
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3 spindle No. 2MA6 Avey, H.S., m.d.
3 spindle Leland-Gifford #1 LMS—H.S., m.d. late
3 spindle Leland-Gifford H.S., m.d.
4 spindle Leland-Gifford, m.d., on each spindle
4 spindle No. 15 Buffalo Bench Type
4 spindle Allen H.S., belt drive
4 spindle No. ⅓ MA8 Avey, m.d., H.S.
4 spindle Demco H.S., individual m.d.
4 spindle No. 2MS Edlund, m.d.
4 spindle No. 2BMA6 Avey H.S., m.d.
5 spindle Allen H.S., belt drive
6 spindle Leland-Gifford, m.d. on each spindle, No. 2 taper
6 spindle No. 1 Avey High Speed, m.d.
6 spindle No. ⅓ Avey MA8 Avey, H.S., m.d.

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Model 410 W.F. & John Barnes, Horizontal Boring & Drilling Machine, m.d.
No. 410 Barnes Single Spindle Deep Hole, m.d.
No. 2 Avey Style MA1, with horizontal operation
No. ½Bx30" Model M1818 Pratt & Whitney 2 spindle Deep Hole, m.d.
No. ½Bx50" Pratt & Whitney Gun Barrel Rifling Machine, Model M1821, m.d., latest
No. 1½Bx105" Model M 1825 Pratt & Whitney 2 spindle Gun Barrel Rifling, m.d.
No. 1 Model M509 Pratt & Whitney 2 spindle Deep Hole Drill, belted m.d.
Natco Horizontal Drill, holesteel model, m.d., 1942
Natco Horizontal Drill, 2 opposed B4F2 Head, 1943
¾"x40" Bausch Double Horizontal Drilling Machine, m.d.
No. 445 W.F. & John Barnes Independent 2 spindle Deep Hole Drilling & Boring Machine, late
Model 2F1 Natco Horizontal Boring & Drilling Machine
No. 1Bx50" Model 1806 Pratt & Whitney 2 spindle Deep Hole

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2 spindle No. 6 Colburn Manufacturing Type H.D., separate m.d. to each spindle
4 spindle No. 201¼ Barnes Self-Oiling Drill & Tapping
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CENTERING MACHINES. Nos. 53 & 56 Sundstrand up to 72" between centers
CHUCKER. 675 New Britain late
DRILL. No. 262 Barnes all-geared upright 1943
DRILL. No. 20 HD Baker hydr. late
DRILL, HEAVY DUTY. No. 262 Barnes, Swing 26", capacity 2", No. 5 M.T., 1943, Q.C.G.
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. H. Landis, 1943
GRINDERS, UNIV. 14" x 14" Mod. 112 Rivett
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER. INT. No. 271 Heald size matic 1951
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GRINDER, 12" x 16" Mattison, 1942
GRINDER, SURF. 20" x 24" No. 25A Heald
GRINDER, SURFACE. 12" x 16" x 36" Mattison. Mag. chuck and rect., 1942
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GRINDER, CARBIDE, Nos. 48 and 49 Excello
GRINDER, RADIUS, No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl., 1941
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO 2-20 Kent Owens, 1942
MILLER, AUTO 36" No. 33 Sandstrand
MILLER HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, PLAIN. No. 2 Cincinnati HSDT, 1940
MILLER PLAIN. No. 3H K & T MSDT 1943
MILLER VERT. No. 2 Brown & Sharpe HSDT. 1943
MILLER. No. 36 VanNorman, ram type, 1942
MILLING MACHINES, HORIZONTAL, No. 5H Kearney & Trecker, plain with Vert. Hd., 1941
ROUTERS. Type A-1R Onsrud Radial 84", late
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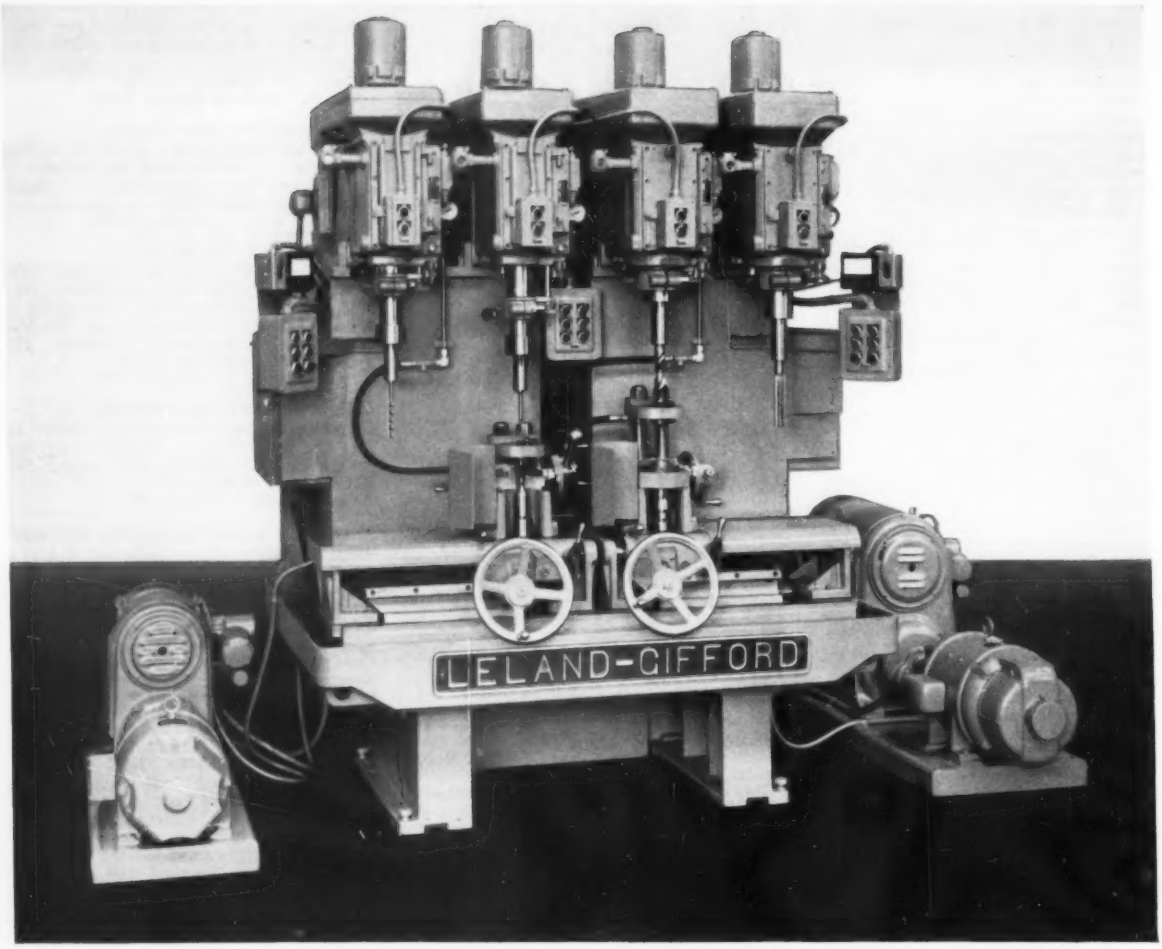

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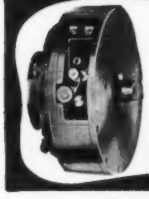

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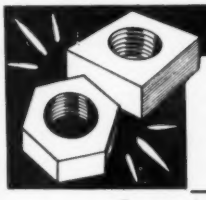

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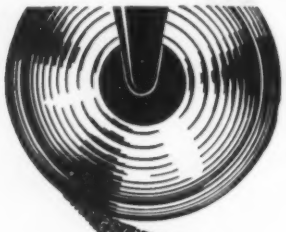

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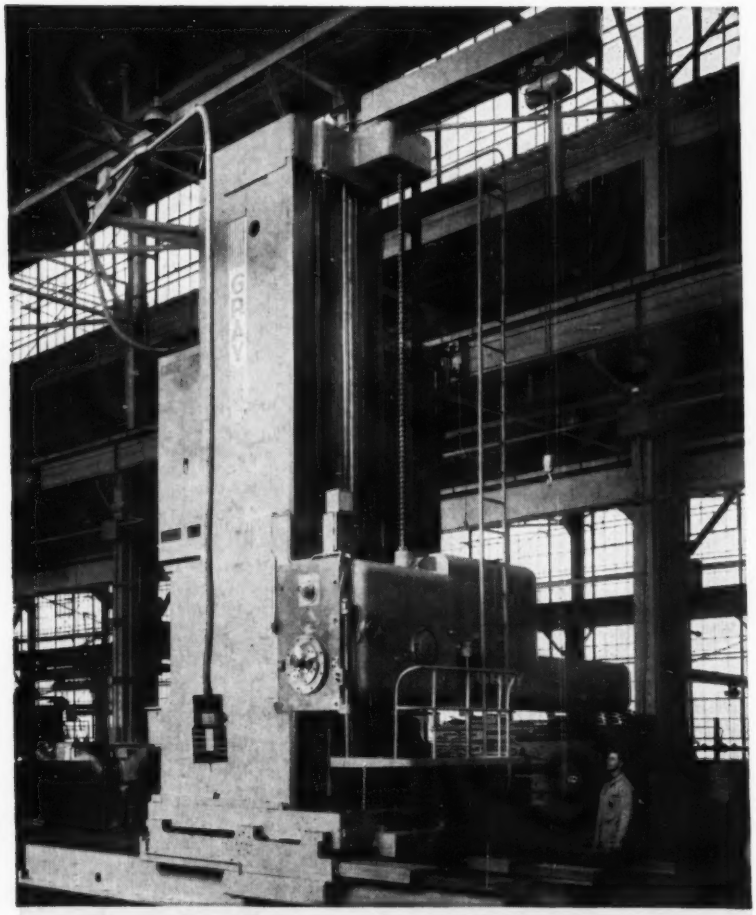

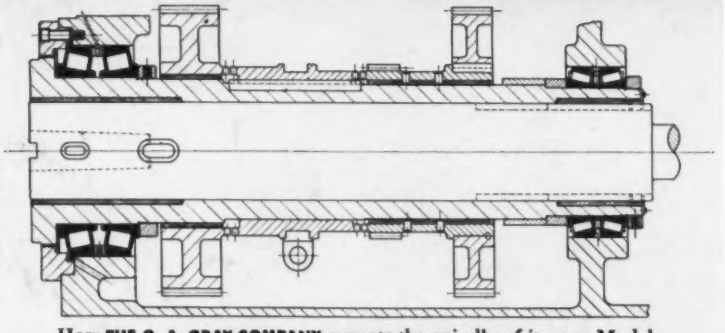

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